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REPORT OF THE

Secretary of Agriculture

1939

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REPORT OF THE

Secretary of Agriculture

1939

WASHINGTON, DECEMBER 1, 1939

To the President

WHAT THE WAR MEANS TO OUR FARMERS

IT HAS been evident for years that the central problem of American agriculture is the problem of its relationship to the world market. This came into general recognition soon after the World War of 1914–18.

In the post-war depression world prices dropped so low that production for sale abroad was unprofitable. Farmers urged that their production for export should be separated sharply from their production for home consumption, so that the home market at least might be reasonably remunerative. The idea became a cornerstone of our national agricultural policy.

The importance of this central problem has not been lessened by the fact that Europe is again at war. On the contrary, the new hostilities remind us with new emphasis that world conditions affect our agriculture vitally and that the problem of achieving an ultimately satisfactory farm adjustment is more difficult than ever. Agriculture can do nothing without reference to this basic fact.

It would of course be folly to regard the new war as in any way a solution of our farm problem. Even should it cause certain prices to rise, so that differentials may for a time not be necessary between prices at home and prices abroad, the need for protecting the home market against the influence of the world market will return with the return of peace. Whether or not the pattern of the last war and the post-war period will be repeated we do not know; but we do know that war usually destroys or reduces the purchasing power of belligerent countries.

Hence the outbreak of hostilities is not a reason for abandoning our efforts to conserve the soil, to keep our farm output in adjustment with the current and prospective demand, and to establish a rural-urban balance on the basis of equitable price relationships. On the contrary, it is a reason for strengthening our machinery to accomplish these ends. Such machinery has already demonstrated

its usefulness as a means of adjustment to war conditions. After the war, if drastic farm adjustment must again be made, it will be a safeguard against market demoralization.

This machinery enables farmers to meet the shock of war much better than they met it 25 years ago. It authorizes two main responses to the foreign-trade problem: (1) The adjustment of production more nearly to the combined foreign and domestic demand; and (2) the raising of domestic agricultural prices above world prices when world prices are depressed, or equivalent action in raising the income of farmers from the domestically consumed part of their production. Methods used to adjust farm production downward can be used to adjust it upward should need arise. Methods developed to protect domestic prices and to provide more income from the domestically consumed than from the export proportion of the farm output may be necessary for some crops during the war and for many crops when the war ends. There is no justification whatever for allowing the adjustment machinery to lapse.

Continued Need for Land Use Planning

Even should there be an improved demand for wheat and cotton and other export crops, we shall need cooperative land use planning. Reckless expansion without regard to the needs of the soil would be eventually disastrous. It would lead to heavy overproduction and would undo the work of years in soil conservation. Land that should not be farmed would stay in or come into cultivation; there would be a new plow-up of the grasslands, with new hazards of duststorms. In the South, if the cotton acreage increased, crop diversification would lag; expansion in the feed-grain areas would hinder the shift from soil-depleting to soil-conserving crops. Our stocks and world stocks of cotton, wheat, tobacco, and feed grains are large. The first 3 months of war have not stimulated the export demand for our farm products. It now appears that our exports in the current marketing year will be smaller than they would have been had the world remained at peace. But if more of our farm products should be required at any time, the farmers through A. A. A.-controlled expansion can satisfy and yet not go beyond the extra need.

Lack of such facilities might mean heavy overplanting in the event of temporarily stimulated demand. Farm incomes are still below parity; farmers are in debt, and behind with farm and home improvements. On a purely competitive basis the average farmer would feel that he could not afford to sacrifice his immediate cash interest for the long-time welfare of the Nation's resources or even for the long-time welfare of his own farm. He would be strongly tempted to repeat the soil exploitation of the World War period, which laid the basis for the disastrous duststorms and floods of recent years. Only cooperative action, supported by Government powers and Government funds, could prevent the same exploitation from occurring if the same price incentives were present.

Of course no one can predict the duration of the war. Agriculture in the United States should be prepared for either a short or a long

struggle. In the event of an early peace, our export opportunity probably will not be better than it was previously, since even a short war will involve great expense to Europe. Meantime the stimulus to prices may be slight. In the event of a long war, prices will probably be higher for a longer time, but if the pattern of the last post-war period is any criterion the resulting depression will be deeper. In either case the need will probably be paramount for farmers to be in a position to guide their production intelligently and to protect themselves and the Nation against undue speculative expansion.

War Hurts Long-Time Trade Prospect

Fundamentally, the new war situation seems to widen the economic gulf between the New and the Old World; it probably sets back further than ever the hope of genuine reciprocal trade between the hemispheres, and substitutes new trade lines some of which are likely to prove abnormal and temporary. In the World War period our farmers expanded their production without thought of the future, partly because they did not realize the extent to which Europe would be impoverished and partly because responses to price prospects were then exclusively individual. Neither of these reasons should now stand in the way of more rational wartime agricultural planning.

As wartime safeguards Federal storage and commodity loans have increased utility. The ever-normal granary, while protecting farmers against price depression, serves also to protect consumers against undue price advances. Commodity loans have stop-loss value, even when prices exceed loan values. They are insurance against price declines. Surplus diversion is in order for export crops that war puts in the luxury class. Low-income groups in this country whose purchasing power does not keep pace with advancing prices will continue to need the stamp plan. Wages usually lag when prices rise.

Many of our underprivileged farmers, the so-called lower third, will still need farm and home guidance, health programs, rehabilitation loans, tenant-purchase operations, and help in shifting from poor to better land. This group, which produces very little for sale, will benefit little from any advance the war may cause in prices, though new jobs in industry may give them a chance at least temporarily to quit farming. Above all, the need will continue to protect the social interest in land use planning. There can be no truce whatever in the fight against misdirected land settlement, wrong use of land resources, wastage of soil and water, and bad land-tenure conditions.

Whatever the political outcome, the economic effects of the war will be bad. It will further dislocate our agriculture. Any temporary rise in prices it may cause will be likely, even with continued acreage adjustment, to bring about an excessive response. That is the way things always go. Farmers who participate in the ever-normal-granary, crop-adjustment, and conservation programs will constitute a stabilizing influence; but rising prices may increase the number of nonparticipants. Even on the adjusted acres, produc-

tion may rise through increased intensity of cultivation. Prudence demands not less but more cooperative land use planning, as a counterweight to the usual tendency of supply to overshoot demand. There should be no great difficulty in satisfying whatever actual increased demand may develop. There may be extreme difficulty in avoiding the ultimate accumulation of heavy surpluses. Our best course is to keep our crop-adjustment system in flexible, yet effective operation.

Farm Adjustment Problem Essentially Unchanged

Some farmers, with the high prices of the last war in mind, may wish to discontinue their cooperation in the farm programs. They should bear in mind that there is no guarantee that the course of prices will follow the pattern of 1914. Supplies of cotton, wheat, corn, meat animals, and many other commodities are large. Our stocks of wheat, cotton, and corn in storage are enough for any probable early increase in the demand. It should be remembered, too, that European countries have large reserve supplies of many crops and that they have made progress in recent years toward agricultural self-sufficiency. In wheat especially they have expanded their acreage and production. Moreover, the ocean transport outlook is uncertain. Even in wartime the overproduction of large quantities of agricultural commodities can be demoralizing. Farmers should always consider prospective as well as current price conditions. In wartime this precaution is supremely necessary.

War simply enlarges the problem of adjusting our agriculture to world conditions without essentially changing it at all. Military factors have dominated the fiscal policies of Europe for two decades. Agricultural price fixing, import controls, bilateral trading, and straight barter have been simply the peacetime prelude to actual military conflict. Sacrificing comfort to security, or imagined security, Europe has struggled toward agricultural self-sufficiency, and as military preparedness has produced at great cost many things it could have imported cheaply. In consequence it has suffered great losses in its export trade. This whole development, the economic harbinger of war, has had the effect of placing international trade in farm products potentially on a war basis. It has obliged the exporting countries to govern themselves accordingly. Our own response has been cooperative crop adjustment plus measures to keep prices abroad from depressing prices at home. Now that war has come, controlled limitation of the farm output may give way temporarily to controlled expansion; but the adjustment principle is of even greater value than before. Methods forced on us by Europe's war preparations will serve also to deal with the consequences.

Possible Effects on Prices and Incomes

General European war will affect prices and incomes received by American farmers in two principal ways: (1) Through changes in the foreign demand for our export commodities; and (2) through its

influence on domestic industrial activity and consequently on the buying power of American consumers. Foreign buying of some products in this country will probably increase while other products will be less in demand. Our relative nearness to Europe gives us an advantage in supplying belligerent countries, and certain neutral countries may turn to us for supplies they can no longer readily obtain elsewhere. Another factor that tends to favor the United States is the ocean-tonnage situation. There is more ocean tonnage available now than there was in 1914, and no shortage is likely to develop for a considerable time. Nevertheless, the demand for shipping will increase. This fact, together with the greater risk involved, will tend to raise ocean freight rates and to give relatively short-haul business a distinct advantage. For normal transatlantic trade, however, the shipping situation may be discouraging.

Certain foreign countries will not lack purchasing power in the United States. They have large investments here on which they can rely for the purchase of farm and factory products. Long-term foreign investments in the United States amount to 5.7 billion dollars. Short-term foreign bank balances here amount to about 2.6 billion dollars. The short-term foreign account includes about 300 million dollars of deposits of foreign central banks which presumably will be available immediately to foreign governments. Total foreign long- and short-term holdings in this country, exclusive of earmarked gold, exceed 8 billion dollars, of which amount Great Britain and France together control about 2½ billions. Neutrality legislation may interfere with the sale of some products; but many important products are not in this category. In short, the conjunction of large foreign buying power with a large available supply of desirable commodities in this country suggests that in a protracted war the United States will do considerable business with belligerent countries.

Probably the tendency will be for prices to rise. As Europe increases its military efforts, it will probably become more dependent on imports. Among agricultural commodities wheat and wool seem most likely to feel the resulting price stimulus. Some of our exportable farm products such as cotton, tobacco, and fruits may not benefit directly; they may even find their export market somewhat curtailed. They will have some compensation, however, in the fact that foreign buying of industrial products in this country may stimulate the home demand for agricultural commodities. Needless to say, however, the effect of the war on prices will be very unevenly distributed by commodities and regions. It may also be modified by exchange and finance control operations, in which field the world has learned much in recent years.

The Inflation Danger

Probably all countries will strive to avoid a typical wartime inflation. Whether or not such a condition will develop irresistibly depends on factors that cannot now be measured. Full inflationary effect requires an expansion of output to the maximum capacity of

available plant and manpower, together with a large expansion of credit. The prospective outlet for American goods seems to be relatively less ample in the present situation than it was during the World War. In the first place, Europe has larger stocks of foods and many war materials; and in the second place, our production capacity is greater. Certainly the possibility exists for an extensive credit inflation in this country; but lending to foreign countries, one of the possible inciting factors, may not develop. Moreover, the United States has an equal interest with other countries in preventing inflationary developments since the aftermath would be disastrous.

It is impossible to foresee in detail how the new world situation will affect our agricultural policies. If long-continued, it might relax the need for price supports and export subsidies. This is more likely to be true of wheat than of cotton. Ultimately, however, it will probably make such things more indispensable than ever, since the progressive exhaustion of Europe's buying power will cut further into our export trade. After the wartime stimulus, we must expect a reaction, with a resulting increased need for differentials between domestic and foreign prices. Therefore, we should retain the means to establish such differentials. It is vital not to throw away the farm programs that were the fruits of our experience following the World War. There is a strong possibility if not a probability that we shall have to go through something very like it again. Even if the present war ends with prospects of enduring peace, Europe's purchasing power will be low.

Farm Response After 1914–18 War

After the last war, with agriculture in excessively high gear, there was wide disparity between farm and nonfarm prices. We turned to the Government purchase and storage of crops, to cooperative limitation of farm acreage, to benefit payments and price-adjustment payments as supplements to low farm income, to price-supporting commodity loans, and finally to export subsidies. The trend, much against our inclinations, was in line with the world trend toward so-called economic nationalism. We could not by ourselves go back to relatively free international trade. And international cooperation was not forthcoming. In remorseless preparation for another war, the nations traded less and less with one another and reverted more and more toward local or national rural-urban balances. There is small prospect that the outcome of the present war will be greatly different. Even if it establishes more favorable political conditions for international trade, it may in large measure destroy the economic basis for commerce. In short, after an interlude more or less brief the United States may be driven yet more rapidly toward self-containment or hemispheric containment.

As we know from what has happened already, the repercussions will be economic, social, and political. While the war continues, the potential consequences will probably be masked. Employment may increase here in urban industry. This will stimulate the domestic

market for agricultural commodities and for a time may draw excessive manpower away from the farms and toward the cities. The danger is that we shall base our hopes for the future on the utterly false assumption that wartime conditions of employment will continue after the war. In the post-war reaction exactly opposite conditions will probably develop.

It is more probable that peace will find us thoroughly maladjusted to peacetime conditions; that agriculture will again be faced with the need of drastic acreage limitation; that rural and urban unemployment will cause a further increase of noncommercial farming; and that commercial agriculture will find itself in more urgent need than ever of safeguards against the depressing influences of world prices. Unless we can shift over quickly from heavy urban production for a world at war to equally heavy urban production for a large domestic consumption, agriculture will lapse back into price depression and stagnation. Any wartime gains it may have accumulated will vanish speedily.

Certain Requirements Evident

Certain requirements we can foresee. Efforts to sustain farm prices will probably be indispensable; they will probably include additional acreage limitation, price-supporting commodity loans, and subsidies to move exports at world prices. Any relaxation of the need for these things now will probably lead to an increased necessity for them later. Along with protective measures for the export crops, companion measures will probably be necessary for the crops domestically consumed. Otherwise any post-war decline of exports will force shifts from the export to the domestic crops. It may be imperative to integrate agricultural with industrial production, through national planning for balanced expansion in both fields and factories. The supreme requirement will be a general increase in domestic consumption as the only possible compensation for declining foreign trade.

Our experience with crop adjustment and with certain kinds of income-raising or price-supporting action provides a choice of methods. Multitudinous in form, the available expedients are few in principle. There is (1) the processing-tax way with adjusted crops; (2) crop adjustment and soil conservation financed by payments from the treasury; (3) price-supporting loans, combined with storage in the ever-normal granary; and (4) the same thing associated with devices such as export subsidies to prevent supplies from piling up excessively in storage. These principles can be applied singly and in combination. Even if prices temporarily justify controlled expansion, some of them will have an important place. In the inevitable post-war contraction of farming, they will probably all be necessary.

It may seem, if the war eventually causes prices temporarily to rise, that crop adjustments, benefit payments, price-adjustment payments, commodity loans, marketing agreements, and export subsidies have lost their justification. Certainly Government payments for the support of farm incomes will then not need to be so large.

Our farm legislation provides for an inverse relationship between farm income and benefit or price-adjustment payments. As the income rises, the price-adjustment payments must decline. However, the need will continue for soil conservation payments. It will be wrong, in short, to conclude that the fundamental reasons for the national agricultural program have disappeared. On the contrary, the wartime gains in farm income will not be real or permanent gains; they will involve corresponding post-war declines. Then the payments will have to be increased again and the crop production reduced. In fact, the war situation modifies only the details of the crop and price-adjustment mechanism. It leaves the principles unchanged.

Ever-Normal Granary Proves Worth

As a striking example, we may note the ever-normal-granary situation. Soon after the war broke out, runs on grocery stores began in this country. Panicky buying for inventory and not for consumption caused temporary increases in the prices of certain foodstuffs. In our ever-normal granary we had ample insurance against food shortage. Better knowledge of the fact among consumers would have prevented the panicky buying. Conceived originally as a protection to farmers and consumers against drought or other causes of actual shortage, the ever-normal granary functions equally well as a protection against sudden increases in demand. It copes effectively with unpredictable changes on either side of the supply and demand equation.

In 1939 farmers carried under Government loan or the Government itself held 80 million bushels of wheat, 260 million bushels of corn, and 11 million bales of cotton. The ever-normal-granary principle applied similarly to sugar. Had the consuming public been aware of the protection available, it might not have been necessary for the Government to suspend the quota provisions of the Sugar Act. The reserve supply was adequate. Our reserves of wheat and corn enable us both to meet any probable wartime increase in the demand and to ensure domestic consumers against a shortage. In 3 years of good corn crops the ever-normal granary has protected corn growers against market demoralization. Now that corn prices are rising, it protects consumers against excessive price advances.

Our carry-over of wheat on July 1 was 254 million bushels as compared with the long-time average carry-over on the same date of about 100 million bushels. World wheat supplies this year are about 5,300,000,000 bushels as compared with only 3,500,000,000 bushels in 1914. There is obviously no justification for a flour run in the United States. On the other hand, farmers who have stored wheat in the ever-normal granary can get the benefit of any price increases; the stored wheat still belongs to the farmers. In cotton we have tremendous reserve supplies—practically a full year's production and nearly three times the normal carry-over. Liquidation of the stored cotton is still a problem; but the outlook is for better prices for it than would have been available last year or the year before.

Crop and Price Adjustment Needs

In brief, it will be necessary during and after the war to have means at hand for crop adjustment and price adjustment. Along with means to adjust the farm production suitably, it will be necessary to have facilities for maintaining some kind of a two-price system. Essentially, of course, this is what we have had since 1933. The first Agricultural Adjustment Act drove a wedge between the domestic and the foreign values of wheat, cotton, tobacco, corn and hogs, and other basic commodities, since it established higher prices to domestic than to foreign consumers. After the Supreme Court invalidated the processing tax we relied on soil conservation with benefit payments and price-adjustment payments. The effect of these payments was to raise the incomes of producers from the domestically consumed portion of their production. Also, we relied on price-supporting commodity loans, which raised domestic above world prices. Finally, as an outlet for impounded surpluses we turned to export subsidies.

Here is the pattern of the procedure which almost inevitably will have to be continued, in one combination or another, for many years. There is no question of going back to laissez faire. For agriculture the problem is simply to get the nearest approach to a permanent equitable farm adjustment with the least drawback in national disadvantage. The only way is to continue broadly along the path we have already marked out. The greatest mistake we could make would be to suppose that any temporary effect the war will have on agricultural prices will make crop adjustment and price support unnecessary. With our experience since the last war fresh in mind, we ought not to be in much danger of making that mistake.

CHANGING CURRENTS IN FOREIGN TRADE

With a new European war in progress it is essential to take stock again of the foreign-trade aspect of our agricultural situation, which greatly affects the welfare of the American farmer whether he happens to be a producer of one or more of the great export crops or a producer of crops that depend entirely on the domestic market.

At the beginning of the decade of the thirties, the foreign-trade prospect for our agriculture was gloomy. One reason was the fact that the main prop of our relatively large farm export trade in the preceding decade had been removed. This prop was our heavy loans to foreign countries. Furthermore, the United States, by the adoption of the Smoot-Hawley Tariff Act, had increased the difficulties of foreign countries in obtaining purchasing power for American goods. Another reason was the fact that European agriculture had by that time more than recovered its pre-war productivity. There was in evidence, indeed, a strong tendency toward even greater farm production in Europe for reasons of military self-sufficiency or otherwise. Finally, competition was extremely keen among the agricultural exporting countries for the reduced world market.

In this situation the Government of the United States took positive action along two main lines. One line was the agricultural

adjustment program, with its broad objective of bringing the total farm output, and particularly the production for export, more nearly in line with the total demand. The second line of action was the reciprocal trade-agreements program.

In adopting the agricultural adjustment program the Government assumed that it would not be possible in the immediate future to restore our farm export markets to the level of the twenties. It did not seem reasonable to expect that the decline caused in foreign buying power by the discontinuance of our foreign lending could or would be compensated for by a sufficient increase in our imports of goods and services. There was strong reason to believe also that the foreign market for American farm products would continue to be smaller than it had been formerly as a result of the trend toward self-sufficiency in the importing countries. Subsequent developments fully justified these assumptions and warranted the concerted crop-adjustment program.

Reciprocal Trade Agreements

It was never contemplated, however, that the readjustment of our agricultural plant should eliminate production for export. On the contrary, the expectation was that our farmers would continue to require foreign markets for cotton, wheat, pork products, tobacco, and fruit. It was necessary to find some means of improving our foreign markets. The method chosen was the reciprocal trade-agreements program, which Congress authorized in 1934. It rested on the fundamental thesis that a nation must buy if it expects to sell. Farm products purchased in the United States by foreign countries whether in peacetime or wartime can be paid for eventually only through equivalent imports of goods and services. The only alternative is debt cancelation. The reciprocal trade-agreements program recognized this fact; it expressed the principle that a creditor nation cannot maintain a healthy export trade if it refuses to accept imports in return.

Specifically, the major objective of the program was to make possible an increase in imports through carefully considered reductions in our own high tariff rates. In return for such reductions it sought reductions in the trade barriers that faced American agricultural and industrial goods in foreign markets. This trade-agreements program has now been in effect for more than 5 years. It has led to the completion of trade agreements with 20 foreign countries. These countries in the past have provided the outlets for approximately 60 percent of our agricultural export trade.

Under the terms of the trade agreements numerous important reductions have been obtained in the barriers that face our agricultural exports. Among the most outstanding of these reductions was one of more than 80 percent in the Cuban duty on American lard. Another important result for American agriculture was the complete removal of Great Britain's import duties on wheat and lard. Numerous other reductions have been brought about in the duties on a wide range of American agricultural export products, and increases have been

obtained on the import quotas that foreign countries impose on some of our agricultural exports.

Necessarily, in order to obtain these concessions, the United States has in turn reduced a considerable number of high import duties. In this way it has permitted larger sales of specialized foreign products in the American market. There is no truth, however, in the assertion that these duty reductions have caused a "flood" of competitive foreign products into the United States. Nor is it true that agriculture has had to bear the brunt of the tariff reductions. On the contrary, the reductions made in duties on agricultural imports have been much less numerous than the reductions made on industrial imports. In cases where some possibility seemed to exist that the reductions in the duties on agricultural commodities might cause an unduly large increase in imports, the duty reductions have been limited to specific quantities. In short, the trade-agreements program has contributed substantially to agricultural improvement.

Trade Agreement Effects Partly Obscured

Certain other developments, however, have tended to obscure the effect of the trade-agreements program. Prominent among them were the droughts of the middle thirties. These droughts reduced our export supplies of certain grain and livestock products very greatly and caused a temporary rise in our imports of certain agricultural commodities. Still more important as a countervailing force was the rise during the thirties of totalitarian States. The economic policy of these States, particularly that of Germany, rests on principles very different from those that animate the American program of reciprocal trade agreements.

The importance of these developments comes into clearer light when we recall the fact that for many years before and after the World War of 1914–18 Germany provided the second-largest single outlet for American agricultural products. In the twenties it took about one-fourth of our exports of cotton, lard, and prunes, and substantial proportions of our exports of most other leading agricultural commodities. Without restoration and maintenance of the German market it was difficult to bring about a substantial restoration of our agricultural export trade. There was no other country, and indeed no other group of countries, that could be expected to increase its imports of United States products sufficiently to compensate us for the loss of a market as large as that of Germany. But the German market was not restored. On the contrary, our farm exports to Germany declined steadily during the greater part of the decade of the thirties.

Our failure to regain the German market resulted mainly from the fact that the German Government during this period followed an intensive policy of national self-sufficiency, particularly with respect to foodstuffs and agricultural raw materials. This policy blocked action toward the negotiation of a reciprocal trade agreement for the United States and Germany. Indeed, it obliged the United States under mandatory legislation to impose countervailing duties on subsidized exports of German products to the United States. Whatever

the basic cause of our failure to regain our share of the German market, and of our failure adequately to restore our agricultural export trade with other countries, the fact remains that the continued weakness of the export demand had a major influence on American agriculture. Our agricultural exports continued to decline, except for a short time during the marketing season 1937–38.

Simultaneously, the most intense competition developed among the agricultural export countries for the greatly reduced export business. This development was conspicuous in the wheat market. By 1938 virtually every wheat-exporting country of any importance had some governmental program in effect to facilitate its wheat exports and at the same time to maintain wheat prices to its domestic producers. There was intense world competition similarly in cotton. As shown elsewhere in this report, our cotton exports dropped in 1938-39 to the lowest level since 1882. They constituted probably the smallest proportion of the world cotton exports since cotton became an important commodity in international trade. The emergency situation in wheat and cotton led the United States Government to adopt export programs designed to obtain for American cotton and wheat a more normal share of the available import demands.

World Collaboration Necessary

As will be shown in more detail later, the export program for wheat attained this objective. It seems probable that the export program for cotton will be equally successful. It has been in effect at this writing for only a few months, but our cotton exports are already running about 50 percent higher than the extremely small cotton exports of the preceding crop year. Adopted to meet an emergency situation, these export programs should not be considered a long-term solution of the export problem for wheat and cotton. They do not solve the problem of making dollar exchange available to our foreign customers. As an emergency device, with the limited objective of retaining for the United States a reasonable share of the world's trade in wheat and cotton, they have ample justification. In the long run, however, the restoration of our agricultural export trade requires a general development of truly reciprocal commerce.

The soundest long-term approach to the problem of agricultural surpluses is undoubtedly some form of international collaboration on a commodity basis. Such collaboration would help to bring about adjustments between the world supplies of wheat, cotton, and sugar in the exporting countries and the demand for these products in the importing countries. Some progress has already been made in this direction. Examples are the international sugar agreement concluded in 1937 and the international agreements on rubber and tin that have been in effect for a number of years. Up to the outbreak of the new hostilities in Europe definite progress had been made toward an effective international arrangement with regard to wheat. With regard to cotton, a meeting of representatives of cotton-exporting countries in Washington in September agreed in general that the lack of balance between export supplies and import requirements

called for international action. The war in Europe for the time has checked progress along this line; but there is a real basis for the hope that the international approach to the problem of production maladjustments may eventually yield constructive results.

Our Trade With Latin America

One effect of the European war on our foreign trade, however, does seem reasonably clear, namely, the tendency toward an increased relative importance of trade with Latin America. This possibility seems to have caused some concern in agricultural quarters in the United States. Visions have arisen of a large influx of competitive agricultural products from Latin America in exchange for large shipments of American industrial goods to that part of the world. There is, as a matter of fact, no basis for any such fears. Undoubtedly we will have larger exports to Latin American countries in the next few years than formerly. Most of these exports will also probably be industrial products, although a substantial increase in exports of agricultural products, such as wheat flour, lard, and certain canned goods is entirely within the realm of possibility. But an increase in exports of industrial products is no reason for alarm in agricultural circles. After all, the best market for American agriculture is the domestic market, and a healthy exportation of American industrial products cannot help but contribute to the prosperity of that market.

Just as in our foreign trade as a whole, our trade with Latin America must be reciprocal. We must expect to import larger quantities of Latin American goods in order to provide those countries with the means for purchasing our export products. These increased imports should be and can be predominantly tropical agricultural products of a kind not at all competitive with our domestic agriculture. In fact, the imports at reasonable prices of such products as rubber are a benefit to the American farmer. It is highly desirable that the United States contribute such assistance as may be needed and desired in the Latin American countries in the direction of building up their production of those kinds of products which we do not produce and which we now import in large quantities from more distant parts of the world.

Temporarily, as a result of the war in Europe, we may find it easier to make sales in Latin America; some of our competitors will be absent from that market. In promoting two-way trade with South America, however, we run into the difficulty that a number of South America's exportable commodities are the same as those of which we ourselves have a surplus. It is necessary for us to encourage South America to produce more of the commodities we need and are accustomed to import. Only one-fifth of our imports came from the 20 Latin American countries up to the outbreak of the present war, and only one-third of their total foreign trade was with the United States. Only one-sixth of our total exports went to South America. Yet an increase in our trade with the other countries of this hemisphere is entirely feasible.

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Possible Imports of Tropical Products

The South American countries can produce a number of important materials, among them tin, antimony, tungsten, bismuth, petroleum, vanadium, platinum, manganese, mica, copper, lead, zinc, and rubber. There is also hope of stimulating the production in South America of farm products that are not competitive with our own. This Department has suggested a number of such products and is carrying on studies to find others. Tropical America is rich in many kinds of hardwoods, and in the United States some kinds of hardwoods are becoming scarce. Among the plants of tropical America that can be of use to the United States, without being in any way competitive with our agriculture, are the cube plant, a source of the powerful insecticide rotenone; the abaca plant, which provides Manila hemp; and the cinchona plant, which is the source of quinine. Certain perfumes and flavoring extracts can be obtained from plants of tropical America.

The best example of a product for which we are now dependent on the Old World and which Latin America could grow is rubber. Though the rubber plant is a native of the New World, we import nearly a billion pounds of rubber each year from the East Indies. Our lack of rubber is the greatest single obstacle to our having a self-sustaining Western Hemisphere. It is true that in Latin America the rubber plants are subject to serious leaf spot disease; but there is no reason to doubt that scientific research will be able to develop suitable disease-resistant strains. In this task it should be possible for North American science and capital to cooperate. The reward of success would be entire freedom from the need to worry about what happens to rubber supplies of the Old World. Representatives of this Department who have visited South America recently report that the Latin American countries are anxious to develop any or all of the products for which they can find ready markets in the United States.

A. A. A. PROGRAM FOR 1940

The Agricultural Adjustment Administration seeks the twofold objective of soil conservation and crop adjustment. The program advances the two ends inseparably. On a large proportion of the farms in the United States crop rotations are the most effective weapon the farmers have against both soil destruction and unprofitable surpluses. Accordingly, the A. A. A. program encourages improved rotation methods consistently with local, regional, and national adjustments in the total acreage of soil-depleting crops. In certain parts of the country this procedure requires additional support from engineering and from other special practices. For example, certain areas in the Great Plains cannot readily be brought into a desirable acreage adjustment and also into an effective soil conservation pattern solely by the adoption of rotations on individual farms. There is need also for Government help in changing the crop and land use pattern through land purchases and the develop-

ment of cooperative grazing enterprises. In general, however, the A. A. A. seeks and obtains the cooperation of individual farmers on their own farms in rotation practices for soil conservation and surplus control.

In 1940 the A. A. A. program will put increased emphasis on soil conservation, provide increased opportunities for participation by small farmers, and give greater administrative responsibility to farmer committees. The program was outlined at a conference held in July, at which A. A. A. State farmer committeemen and others conferred with Federal officials. This conference brought together the recommendations of previously held regional meetings that had developed recommendations from State, county, and community groups of farmers. There will be no major change from the 1939 program.

It is advantageous, from the standpoint of farmer understanding and participation, to keep the major provisions as nearly as possible the same from year to year provided they give promise of reasonable effectiveness. Changes should be adopted in any particular year with caution and only on the basis of reasonable assurance of success. Adherence to this principle does not preclude recognition of the fact that certain features of the program are open to improvement, and it allows for progressive readjustment on the basis of research and experience.

The Storage of Soil Fertility

Soil fertility is the most important thing in our ever-normal granary, and the store of fertility upon which farmers must draw to meet requirements for farm products has been enhanced by the progress that has been made in conservation farming. Conservation farming need not conflict with abundance. Corn farmers have filled the ever-normal granary to overflowing from a materially lower acreage than they have grown in past years. This means that corn farmers can put acreage which once was needed to supply corn to uses that conserve and build soil fertility. The current level of corn supplies and higher corn yields have emphasized both the necessity and the desirability of a lower corn acreage for 1940.

This is altogether to the advantage of farmers. As they lower the acreage needed to grow the corn requirements of the Nation, they increase the efficiency of their production. This conservation farming has not restricted feed supplies. This year we have about double the carry-over of corn, and the carry-over of hay is unusually large. The added store of fertility and of nonperishable farm supplies has put farmers in a better position to meet any situation that may occur either from adverse growing conditions or from a heavier market demand.

The corn loan and the rest of the corn program are becoming established firmly as a part of the necessary provision for a more stable and more prosperous agriculture. If in any year the corn crop is so large that the supply exceeds the requirement for current use and safe reserves, farmers can correct the situation through acreage adjustments the next year. It seems probable, in fact, that

they will be able in 1940 to grow sufficient corn on a smaller acreage than that of 1939. With increased use of hybrid seed, increased use of fertilizer, and better farming methods and equipment, the acreage requirement in future years may decline still further. Farmers will benefit from the resulting drop in the average cost per bushel and also from the better chance they will have to protect their land against erosion and to maintain its productivity.

Careful, progressive planning can make the conservation phases of the program more effective. Two principal types of A. A. A. action promote the conservation of the soil. Under certain conditions conservation results effectively from changes in the cropping system—specifically, by planting smaller acreages of the highly exploitative intertilled or soil-depleting crops and by increasing the acreage of the soil-conserving crops such as hay and pasture. Under other conditions the most effective procedure may be the institution of soil-conserving practices such as terracing, contour cultivation, furrowing, water spreading, basin listing, strip cropping, and the like. The A. A. A. programs, developed under the Agricultural Adjustment Act of 1938, have succeeded in reducing the acreages of soil-depleting crops for which definite adjustments were sought. The reductions have been greatest in the acreages of cotton, corn, tobacco, and wheat. In addition, the program has brought about a considerable increase in terracing, contour farming, listing, and strip cropping and the use of green manure and cover crops and lime and fertilizer applications.

Farmer Participation in Program

Nearly 6,000,000 farmers cooperate in the A. A. A. programs and also participate in local, State, regional, and national program planning. Local farmer committees are functioning in more than 3,000 agricultural counties. Farmers administer the program locally through these committees and exert an influence also through their recommendations on general-policy formulation. Altogether there are more than 100,000 of these farmer committeemen; they represent a new force in American agriculture and a new method of bringing farmer experience and farm views to bear on the national farm policy.

Every year since 1935 farmers in the A. A. A. programs have reduced the more exploitive land uses, increased the area in soil-conserving crops, and contributed to desirable supply adjustments. In the aggregate they have diverted about 30,000,000 acres from soil-depleting crops to grasses and legumes. In 1938 the harvested area in soil-depleting crops was down to about 293,000,000 acres. The A. A. A. goal for the time being for these crops is from 275,000,000 to 290,000,000 acres. Along with this adjustment, which meantime provides ample farm supplies both for domestic consumption and for export, the program improves the soil. In 1938 new seedings of grasses and legumes exceeded 30,000,000 acres, and the acreage in green-manure and cover crops exceeded 25,000,000 acres. This was about double the acreage in green-manure and cover crops under the program of the previous year.

Farmers in 1938 improved more than 3,000,000 acres of pasture by reseeding and applied 5,547,000 tons of lime and fertilizer to soil-conserving cropland. In the Northeastern States a sufficient proportion of the farm land is already in pasture and hay. The program in that region now is essentially one of continuing the use of soil-conserving practices and increasing the productivity of the land.

In the South the program encourages more food and feed production for consumption on the farm and less production of cotton. The accompanying shift away from the cotton single-crop system is tending to bring about a more permanent type of agriculture. In the East Central States farmers are building up their land for pasture and hay crops.

Cooperating producers of wheat, corn, and cotton have contributed to the maintenance of an ever-normal granary and to a better regulated flow of these products to market through the storage of surpluses under Government loans. Commodity loans made available for these crops by the Government supplement action taken through acreage adjustments, marketing agreements, surplus-removal programs, and the food-stamp plan.

In the Corn Belt the corn-acreage situation, combined with the ever-normal granary, is steadily improving the corn-hog adjustment. In like manner, the wheat program, with its fourfold union of acreage adjustment, storage in the ever-normal granary, crop insurance, and promotion of exports, is similarly improving the wheat situation.

The Dry-Farming Regions

In the dry-farming regions, where much of the native grassland was destroyed to meet a temporarily expanded grain market during and after the World War, inadequate moisture made cultivation highly hazardous, and the land, stripped of its protective cover and exposed to winds, wasted rapidly. About 15,000,000 acres of such land should be retired from intensive cultivation in the Great Plains and restored to native cover.

Some of the most hazardous of the lands have been purchased outright under title III of the Bankhead-Jones Farm Tenant Act. The Farm Security Administration has made long-time loans to resident operators to enable them to lease from absentee owners lands which can be developed as a grazing enterprise.

In 1938 the A. A. A. initiated a "restoration land" program, under which about 3.5 million acres of this land was designated for retirement and restoration to native cover. It was the first program of this type and was frankly experimental. Major problems involved are getting the land properly designated, and finding methods of restoring cover on it, and keeping it in native grass. Through these and other A. A. A. procedures the dry-farming regions are advancing toward a more secure type of farming.

Rebuilding of another agricultural resource, the range, is also proceeding under the A. A. A. program. Overstocking and droughts, especially the droughts of 1934 and 1936, have cut deeply into the productivity of the range. During 1938, 45,168 ranches were par-

ticipating in the range-conservation program as compared with 37,355 in 1937 and 12,428 in 1936. The ranches participating in the 1938 program covered an area of approximately 189,851,257 acres of range land and 557,000 acres of mountain meadowland. The number of acres included in the range program has increased from 49,039,000 in 1936, to 154,553,362 in 1937, and 189,851,257 in 1938.

Through deferred grazing 28,077,076 acres of range land were reseeded in 1938; more than half of the participating ranches contributed to range-cover restoration through this practice. The construction of earthen tanks or reservoirs was one of the most improved practices. Widespread were also the construction of rubble-masonry dams and the drilling of wells, particularly in Oklahoma and Texas. The development of springs and seeps was a common practice in all the range States. In many range areas where drought was severe in 1939 the range program helped ranchers to retain their livestock and prevented forced liquidation such as was general during the drought of 1934.

Principles in Acreage Allotments

In combining soil conservation with crop adjustment for the maintenance of reasonable farm prices and farm incomes, the coordination of A. A. A. procedures is necessarily complicated. Conservation mainly requires a desirable balance between broad groups or classes of crops, along with better conservation practices. Effective acreage control, on the other hand, requires the establishment of individual crop limitations or allotments.

On an exclusively conservation basis of setting up allotments farmers whose crops are already well adjusted would tend to receive an allotment similar to or identical with the rotation they actually follow. As the result, much of the available A. A. A. money would go for maintenance only. Little would be accomplished on such farms either toward additional acreage control or toward greater conservation. Conversely, with acreage adjustment as the main objective, it would be necessary to make the payments largely on the farms that are more seriously out of adjustment. This might weaken the incentive of the "adjusted" farmers to maintain their desirable adjustment.

Practically, the problem is to establish allotments and methods of payment that will keep the well-balanced farming systems already developed and at the same time leave sufficient funds to induce adequate crop changes in farming systems out of adjustment. There has been progress toward this end each year since the programs began.

Problems of Croppers and Tenants

The A. A. A., since its beginning, has framed its programs with the problems of croppers and tenants in mind. The Agricultural Adjustment Act of 1938 specifically provides for increasing the payments to producers whose payments are less than $200. Regulations of the A. A. A. provide that if on any farm in 1939 any change

of the arrangements which existed in 1938 is made between the landlord and the tenants or sharecroppers, as a result of which a greater proportion of the payments might go to the landlord, the payments to the landlord in 1939 shall not be greater than they would have been had the 1938 arrangement remained in effect and provided further that the county committee certifies that the change is not justified and disapproves such change.

Furthermore, the Secretary may withhold, in whole or part, any payment to a person who employs any scheme or device the effect of which would be or has been to deprive any other person of any payment to which he normally would be entitled.

These regulations are designed to minimize displacements or a shift to a wage hand status which mechanization, less intensive commercial crop production, and other factors tend to bring about. The problem is one that must be considered in all our commercial crop areas. It is an important problem in the corn and wheat areas as well as in the cotton areas, although the situation in the South has received more public attention.

Landowners, in whatever part of the Nation, will not permanently retain the same number of tenants or laborers to grow their crops if they can get along with a smaller number. They cannot do so and maintain their competitive position, live, pay taxes, and other overhead costs. The problem is likely to grow more serious and is one for the Nation to attack.

Aids to Rural Employment

Necessarily the major effort of the Department has been to support and increase the total agricultural income and the levels of farm prices. It has employed rehabilitation loans and grants, marketing agreements, surplus removal, benefit payments, production adjustment, commodity loans, and marketing controls. There are problems in population adjustment, however, which must be dealt with by other means. It probably will be necessary, pending the full revival of urban employment, to give attention to the possibility of employing surplus rural workers in extensive public-service and other public programs in rural areas. In the South we can develop new and increased uses of labor on farm-forestry and other cooperative programs. Experiments with various devices and techniques will be necessary to develop new patterns of living for underprivileged rural people, and to provide better conditions for millions who at present have no secure status and no sure livelihood.

The problem of building a continuing profitable agriculture has not been displaced by the problem of meeting a war situation. Every emergency—excessive surpluses, drought, or uncertainty of war demand—is a test of agriculture's ability to take the long view. Since the Agricultural Adjustment Administration began its operations, farmers have advanced toward a continuing profitable agriculture despite a series of emergencies. They have learned to work together. They now have a pattern for an equitable division of the market. They have made progress toward soil-conserving farming. They

are laying the foundations for an ever-normal granary to regulate the flow of farm products to markets. These things evidence the forming of a national policy.

MARKETING AGREEMENTS, SURPLUS REMOVAL, AND THE STAMP PLAN

Agricultural marketing agreement and surplus-removal programs are an integral part of the national farm program. They supplement the adjustment, conservation, and ever-normal-granary provisions of the general program and are designed to assist producers in stabilizing marketing conditions and expanding domestic and export markets.

There is a close interrelationship between the marketing agreement and surplus-removal programs. They are frequently developed together and serve to round out effective marketing assistance for producers of certain commodities.

The agricultural products for which these programs have proved most effective, and those for which most of the marketing agreement and surplus-removal programs have been in effect, are dairy and poultry products, and fruits and vegetables. In general these are also the commodities which have not been affected so directly by the adjustment and conservation programs.

While the primary purpose of the agreement and surplus-removal programs is to assist producers in the orderly marketing of their crops and to remove price-depressing surpluses, thus protecting farm income, the interests of consumers are given full consideration. No attempt is made or can be made under these programs to raise prices above the levels that would give farmers a fair return. In fact, stabilized marketing proves of direct benefit to the consumer, and the surplus-removal programs make millions of pounds of foodstuffs available to needy families who otherwise could not get them.

The agricultural-marketing-agreement programs were first made available to producers by the Agricultural Adjustment Act of 1933. Amendments to the act in 1935, and the subsequent Agricultural Marketing Agreement Act of 1937 strengthened the provisions and clarified the legal status for marketing-agreement programs.

Decisions of the United States Supreme Court

The United States Supreme Court decisions on June 5, 1939, in the New York and Boston milk-order cases were of great significance for the marketing-agreement programs. These decisions upheld the validity of the programs in the two milk markets and confirmed the constitutionality of the Agricultural Marketing Agreement Act of 1937 under which the orders were issued.

The ruling of the Court in the Boston case marked the high point of an almost continuous legal struggle since a Federal milk-marketing program first became effective for that market late in 1933. In addition to settling major legal questions, the decision freed for payment to producers nearly $3,000,000 which had been impounded by a lower court pending the milk handlers' appeal to the Supreme Court.

The money represented payments due from handlers to producers through the equalization pool in effect in the Boston milk market under the order. The funds, accumulated during a period of 17½ months, meant an increase in producers' returns of slightly more than 20 cents per hundredweight for milk delivered during that period.

The decision of the Supreme Court in the New York case restored to producers a program for what is generally regarded as the world's largest fluid-milk market. More than 60,000 producers in 6 States produce for this market milk which has a farm value of approximately $100,000,000 annually.

The Supreme Court's ruling upholding the validity of milk-marketing-agreement programs is of far-reaching importance to the dairy industry and to the agricultural cooperative movement in general. The decision also lays the basis for closer coordination between the work of State agencies and the Federal Government in developing Federal-State programs to deal with marketing problems.

Marketing Programs in Effect in 1939

More than 40 marketing-agreement programs were in effect during 1939. These included programs for such farm products as fruits, vegetables, nuts, and hops, as well as for milk and dairy products. During the year these programs have affected approximately 1,300,000 producers.

With 6 years of operation behind them, much of it necessarily experimental, marketing-agreement programs are taking their place as permanent machinery available for agriculture in dealing with certain phases of the complicated marketing problem. Democratically administered and put into effect only when approved by a two-thirds vote of the producers concerned, the programs make it possible for farmers to work together in stabilizing their marketing activities.

Programs which are carried out by the Department to remove burdensome agricultural surpluses from ordinary market channels and to encourage increased domestic consumption or export of certain commodities are authorized under section 32 of the 1935 amendments to the Agricultural Adjustment Act. This legislation makes available for programs to increase distribution an amount equal to 30 percent of annual customs receipts. Additional funds have also been provided by other legislation.

Surplus-Removal Programs

Three principal types of programs are designed to widen markets and remove surpluses. They are: (1) Export programs, (2) diversion and new-use programs, and (3) programs to encourage increased domestic distribution and consumption. All of these programs assist the farmer in moving surplus supplies of agricultural commodities which otherwise would seriously depress prices.

Two major export programs, for wheat and cotton, have assisted United States producers in holding their fair share of the world markets.

It became increasingly apparent during the summer of 1938 that United States exporters would not be able to continue anything like normal sales of wheat and flour abroad without some form of Government assistance. All other leading wheat-producing nations were already subsidizing their exports. The wheat and flour export program was put into effect in August 1938, and sales of United States wheat for export during the fiscal year 1939 amounted to 118,000,000 bushels. The exportation of approximately 94,000,000 bushels of this total was assisted directly by the export program.

The Department inaugurated a cotton-export program on July 27, 1939, to meet the situation brought about by declining United States exports. Through September 30, under this program, 2,420,000 bales had been sold for export. This was an amount equal to about two-thirds of the total exports of cotton for the previous marketing year.

Diversion and new-use programs were carried out during 1939 for cotton, peanuts, sweetpotatoes, and other crops. These programs seek to develop and encourage new uses for farm products and to divert excess supplies into byproduct channels. Many of these programs are conducted on an experimental basis, seeking future outlets for agricultural production.

Relief Distribution of Surpluses

In many ways the most important of the surplus-removal programs are those that increase domestic distribution to needy and undernourished families. Two methods are used to accomplish this result. Surpluses bought by the Federal Surplus Commodities Corporation are donated to State welfare agencies for distribution to relief families and increased food-buying power is given directly to low-income families through the food-order stamp plan. The purchase and State-welfare-distribution program has been in operation for several years; the stamp plan was started in May 1939 as a new approach to the problem of getting farm surpluses onto the dinner tables of families that need them.

No problem has challenged the Nation more seriously in recent years than that of finding ways of getting the plentiful supplies which we are able to produce into the hands of those who need them. Studies of consumer incomes made a few years ago showed that 40,000,000 of our people are living in families whose average cash income is only $9 a week. About one-half of these 40,000,000 have been getting some form of public assistance, and it has been estimated that many millions of families in this group are spending an average of only about $1 a week per person for food. That means but 15 cents a day, or 5 cents a meal, for food purchases. It is not surprising that farmers have had trouble marketing part of their production and that malnutrition has been a vital problem for our lower-income people.

Faced with these facts, the Department has developed specific programs to bridge the gap between price-depressing surpluses on the farm and vital need for these same food supplies among our consumers.

Under the direct purchase and distribution programs about 2 billion

pounds of foodstuffs were distributed during the fiscal year 1939, to an average of nearly 3 million families each month. More than 30 different commodities were bought and distributed. These included dairy and poultry products, flour and corn meal, and various fruits and vegetables.

A national school-lunch program proved to be one of the most important features of the direct purchase and distribution operations. Donation of surplus commodities, bought by the Federal Surplus Commodities Corporation, made possible free school lunches in 14,000 schools in low-income areas, serving a total of more than 800,000 children. Schools in every State, as well as in Puerto Rico and the Virgin Islands, participated. The free-lunch program is a joint project carried out in cooperation with the Work Projects Administration and local educational, civic, and welfare agencies. Definite expansion of this school-lunch program was started in the summer of 1939. It was hoped that the program would be serving 5,000,000 undernourished children by the end of the current school year. Such expansion would not only provide health-building lunches for millions of needy children but would also provide additional outlets for agricultural surpluses.

Food-Order Stamp Plan

The food-order stamp plan, which was inaugurated on May 16, 1939, was developed by the Department in response to the need for still more effective ways of increasing the home market for the American farmer. The greatest opportunity to increase the domestic consumption of food lies in the field of farm products for which there is an elastic demand. The consumption of dairy and poultry products and of fruits and vegetables goes up and down with consumer income. When income is low the consumer is likely to go short on these commodities, even though his diet and health may suffer. The stamp plan gives low-income consumers the buying power to secure these needed foodstuffs.

Under the stamp plan, which is entirely voluntary, relief families may purchase orange-colored stamps at the rate of $1 a week for each member of the family as a minimum, or at the rate of $1.50 a week for each member of the family as a maximum. For each dollar's worth of orange-colored stamps purchased, 50 cents worth of blue surplus stamps are given free to the family. Both types of stamps can be used for food in any grocery store in the area in which the plan is operating.

The orange-colored stamps can be used for any food usually purchased in grocery stores and also for such items as soap and starch but cannot be used for tobacco or alcoholic beverages. The blue surplus stamps can be used only for those food products which are declared by the Secretary of Agriculture to be surplus and are listed in the surplus-commodity bulletin in force currently. The blue surplus stamps represent a 50-percent increase in food purchases by relief families. They mean that each member of the family can

spend at least $1.50 for food, instead of the $1 which was being spent in most instances before food stamps were available.

In addition to providing a wider market for the farmer and supplementing the diet of needy families, the operations of the stamp-plan program help all business by bringing about an increased flow of foodstuffs through the normal channels of trade.

Following the inauguration of the stamp plan in Rochester, N. Y., the program was put in operation on an experimental basis in five other cities during the summer of 1939. By the end of the summer preliminary studies showed that the mechanical operation of the plan was satisfactory and that the results accomplished were encouraging enough to warrant gradual expansion of the plan to other cities throughout the country. It was evident that a much longer period would be necessary to determine definitely the complete economic effect of the program. Continued close study and observation, therefore, will accompany the gradual expansion.

Benefits to Agriculture

Evidence at hand now, in the fall of 1939, shows clearly that the stamp plan promises significant new markets for various agricultural commodities. Actual purchases made with the blue surplus stamps up to this time indicate that low-income consumers, given increased buying power, will purchase sharply increased amounts of dairy and poultry products, and fruits and vegetables, as well as other agricultural commodities. The potential new market for these elastic demand commodities, if the stamp plan were in operation on a national basis, is of vital interest to agricultural producers.

Present conditions seem to warrant the expansion of the food stamp plan to include 90 to 100 cities or areas by the end of the fiscal year. Prices of many surplus agricultural products are still so low that the returns to farmers do not provide a fair exchange value for the manufactured goods which farmers must buy, and there are millions of our own citizens who are existing on inadequate diets.

Within each city, however, there is a possibility that the number of families eligible to participate will decline if the current trend toward fuller employment continues. A man with a job at good wages provides the farmer with an even broader market than can be made possible through food stamps, and he provides the grocer with a greater volume of business than he is now getting even in cities where the stamp plan is in operation.

From the very beginning an effort has been made to build the administrative machinery of the food-stamp plan upon a flexible basis. In times of great agricultural surpluses, which usually are accompanied by great unemployment, it will be there to do a minimum job in terms of minimum diets below which the public health would be endangered. The broader market thus made possible for farmers in times of stress will help to stabilize our whole economy. In times of fuller employment, however, it can and should be re-

stricted to the fewer families who would still be eligible for such assistance.

The stamp-plan program is flexible enough to meet changing conditions, and future decisions as to its expansion or contraction will be based upon these conditions. All of the increased distribution and surplus-removal programs are subject to this same adjustment. They are designed primarily to assist farmers in moving price-depressing surpluses and widening their markets, and the extent of operations under them will be governed by current conditions.

FARM PRICE AND FARM INCOME POLICIES

Everyone recognizes that the stabilization of farm incomes in balance with nonfarm incomes under existing world conditions poses a truly national problem, in the solution of which Federal action of some kind is indispensable. Three principal approaches have been advocated and, indeed, tried in one form or another during the last 6 years: (1) Direct subsidies from the Treasury, designed as compensation to farmers for losses suffered while furnishing the Nation with food and clothing under adverse conditions; (2) production adjustments to bring production more nearly into line with the effective domestic and foreign demand, and particularly to reduce overproduction for export; (3) direct price-supporting measures, either for the whole or for a part of a given crop. As I have said, the war situation probably means that ultimately we shall have increased need for measures of this kind. It will be useful, therefore, to see what they involve.

What would happen to farm prices and farm income if we eliminated price- and income-supporting measures and depended exclusively on long-time conservation and production-adjustment programs with benefit payments? It is impossible to answer precisely. There are too many different possible procedures. Suppose, for example, we discontinued the corn-loan program. Would that involve merely the cessation of further loans, or would it in addition involve an immediate liquidation of corn now under loan? The effect in the one case would be very different from the effect in the other. In like manner, the effect on cotton prices and income would be one thing if we merely stopped any further lending or export-subsidy operations, and quite another if we attempted suddenly to liquidate the Government's stocks.

Even more serious long-time questions have to be considered. Acreage control and conservation payments tend to increase the efficiency of production per acre or per farm. How would this affect the ultimate volume of production? In restricting acreage it is desirable to take out of production the least productive tracts or the tracts least suited to production on each farm. This means that the production, with normal yields, declines less than the acreage. Furthermore, with acreage limitations farmers give better care to the land that remains in production. They may apply more fertilizer on it and do other things to increase the yields. Reliance on acreage

control and conservation, independently of measures to support prices and income, would reduce the unit costs of production but perhaps ultimately would not sufficiently control the actual production.

There is some question as to what extent farmers would cooperate in a program confined to conservation and benefit payments. Our experience in 1936 and 1937, with an approximation to that type of program, provides some evidence. For example, in 1937 the harvested cotton acreage was 33,930,000 acres as compared with 26,866,000 acres in 1934. It will be recalled that in 1936, after the United States Supreme Court invalidated the original Agricultural Adjustment Act and after Congress repealed the marketing and quota laws for cotton and tobacco, the national farm program emphasized mainly soil conservation and made acreage limitation subsidiary. Satisfactory acreage control probably could not be obtained under an agricultural conservation program by itself unless farm prices were at a relatively low level.

Requirements for Wheat

Acreage control with benefit payments would not by itself make a satisfactory program for wheat. Yields of wheat vary considerably from year to year; moreover, we normally produce considerable wheat for export. Wheat-acreage control would be really effective only if it reduced the output down to the domestic consumption or lower. That would be extremely drastic. In short-crop years it would involve heavy wheat imports. Supplementary features of our national program, such as commodity loans, crop insurance, parity payments, and export subsidies seem indispensable for wheat. Much more drastic acreage reduction than anything yet contemplated would be necessary in cotton likewise to reduce the supply enough to have an effect equal to that of the existing diversified program.

Extremely important, of course, is the question as to what compensating appropriations could be obtained, should farmers assent to the abandonment of price-supporting measures. Increases would have to be very large. Farmers prefer adjusted prices to endless drains on the Treasury; they believe adjusted prices, at least in the domestic market, are more desirable and can be achieved more easily than equivalent income adjustments based on heavy taxes. Measures to give agriculture the equivalent of the tariff protection that urban industry receives are socially equitable as well as economically sound. Letting domestic prices drop to the level of world prices and making up the difference out of the National Treasury, does not seem to be a workable alternative.

The present policy, with its tendency to establish prices higher in the domestic than in the foreign market, lightens the burden on the Treasury, without overburdening the consumer. Moreover, it looks toward discontinuance eventually of the more expensive parts of the current program. Relinquishment of price-supporting devices, on the other hand, would put an intolerable burden on the Treasury. The conclusion is irresistible that acreage control and soil conservation, though basic requirements, require supplementary de-

vices, which in themselves can aid crop adjustment and soil conservation. Farmers qualify for parity payments, for example, by staying within their acreage allotments. In the same way they become entitled to crop loans. This powerful compliance-incentive makes the whole program more effective.

Release of Export Surpluses

In its original form, with no companion devices to prevent it from hurting our export trade, the commodity loan came under strong attack. It seemed to be the least desirable feature of the agricultural program. Commodity loans that tie in with export subsidies, however, need not hold exports back. As we have seen, the alternative to some form of domestic price raising is tremendous congressional appropriations. It seems, therefore, that the commodity-loan principle should be regarded along with crop insurance, parity payments, surplus distribution, and marketing quotas as a useful supplement to the general approach.

On corn the commodity-loan principle is effective without the addition of an export subsidy. Our corn exports are relatively small; most of the corn is fed to livestock, which in turn are chiefly for domestic consumption. The Agricultural Adjustment Act contains a schedule to regulate the level of corn loans to corn supplies. This schedule resulted in a corn loan above the market price in 1938 and seems likely to require a corn loan above the market price for the current year. It is therefore an important means of increasing the incomes of farmers who stay within their acreage allotments under the conservation program. Loan stocks of corn must not be allowed to become too great, and the loan program must be dovetailed with corn-acreage adjustment.

Some persons advocate a straight subsidy to farmers. They would not ask the farmers to contribute in any way, either individually or collectively, to a solution of their difficulties. All prices would be left to seek their natural levels. All Government effort to influence the kind and quantity of production, except through economic information, would cease. Farmers would simply get a subsidy from the Treasury large enough to bring their incomes up to a minimum subsistence level. Rural opinion does not take kindly to such a suggestion. Farmers want their incomes increased mainly through an approach to reasonable prices and not mainly through hand-outs from the Government. They want the centralizing power of the Government as an aid to farm improvement, but they do not hold the Government solely responsible for the job.

Farmers have welcomed payments from the Treasury only as a temporary expedient until a more favorable market situation develops. They have cordially accepted the obligation, moreover, to use the payments as a means of eliminating or modifying the causes of farm depression. They continue to look for permanent improvement to measures that will increase their incomes by other means than drafts on the public revenue, among which are price-supporting devices of various kinds, and certain broad adjustments in the use of

our natural agricultural resources that may contribute to this end. Conservation, for example, lowers costs of production, though it cannot meet emergency situations brought about by droughts, sudden economic changes, or wars. In grave emergencies, as in periods of prolonged disparity between farm and nonfarm forces, some direct measures for the support of prices will be indispensable.

Types of Price-Supporting Measures

There are two principal types of price-supporting measures. One type seeks to raise the level of prices for the entire supply of the commodity involved; it affects equally both the portion domestically consumed and the portion available for export; it may rely on the price-supporting loan. Prices of a number of agricultural commodities, including cotton, wheat, corn, and wool have been supported in this manner during the past year.

Serious difficulties arise in connection with this method of attempting to support the prices of farm products.

Commodity loans applied to products consumed entirely in the domestic market, with neither imports nor exports involved, tend to build up supplies in storage. These must be disposed of eventually. Hence, the early beneficial effect on prices tends to be more or less offset by adverse effects later. Applied to crops grown for export as well as for domestic consumption, such loans may put domestic prices out of line with world prices. It is then difficult or impossible to export the export surplus. Meantime, foreign buyers look to other surplus-producing nations for their supplies; foreign production increases; and the bad effects on our own foreign trade may be lasting. Eventually, as stocks of the commodity increase within the United States, the price-supporting effect of the loans diminishes or fails entirely.

Resort to the second type of price-supporting measure may then be necessary. This type avoids the dangers of supporting the price level for the entire supply of an exportable commodity; it supports only the price of the domestically consumed portion and maintains the export movement on the basis of competitive world prices. In other words, it establishes a price differential between the domestic and the export supply and raises directly only the domestic price. It obtains higher prices from domestic sales of the commodity in line with the greater purchasing power of consumers in this country and with the general levels of the domestic prices of other commodities.

The Two-Price Principle

All this means the establishment of what is sometimes called a two-price system—one being a fair price in the American market, and the other a price for the exportable surplus which will move it into competitive world trade. As a result, it may be possible to safeguard the general domestic level of agricultural prices from some of the effects of economic depression abroad and at the same time to maintain our place in world markets to take advantage of

any possible future improvement which may occur in the international situation.

There are many possible methods for maintaining such a two-price system, all of which rest on the same principle. This principle involves: (1) The establishment of a higher effective price in the domestic market, with consequent limitation of the quantity available for domestic consumption to the amount that will be consumed at the desired price, and (2) the disposition of the remainder of the total production at whatever price it will bring in freely competitive world markets. This principle can be carried out in four different ways: (1) Through export subsidies, (2) through direct limitation of the quantity available for domestic consumption, (3) through the taxing of domestic consumption, and (4) through the fixing of domestic prices. The first and third of these four methods already have been tried with some success. Proposals to try the other methods have been made during the last year.

An export subsidy is a payment by the Government to exporters. It enables them to pay a higher price for the commodity in the domestic market than they can obtain for it in the world market. Ordinarily, for example, the price of wheat must be at least 15 cents lower in a middle-western market than in Liverpool, if exporters are to buy the wheat in our market, pay the costs of transportation, and deliver it in Great Britain without a loss. If the Government is willing to take a loss of 15 cents per bushel on all or a large part of the wheat moving into export channels, it can, in effect, bid up the domestic price of wheat relative to world prices by approximately that amount. This increase in price applies to wheat for domestic utilization as well as for export. The domestic price is held above the effective world price for wheat. The subsidy enables the United States to continue to export as much wheat as would have been sold abroad at lower prices without the subsidy. The exact effects of the subsidy depend upon other conditions prevailing at the time, but the general results are as indicated. With a larger or smaller subsidy, the results would be correspondingly affected. In the marketing season 1938–39, the wheat loan and other influences held the domestic price of wheat far above world levels. It was necessary, therefore, to pay a subsidy of considerably more than 15 cents a bushel to maintain a desirable volume of exports.

Under the second possible two-price arrangement, with direct limitation of the quantity available for domestic consumption as the principal approach, the Government could require processors to buy processing certificates. These certificates would be issued in such quantity as definitely to limit the total amount processed for domestic consumption. The total price paid by the processor for the portion of the commodity intended for domestic consumption would consist of the market price plus the price paid for the certificates. Funds derived from the sale of the certificates would be prorated to producers in one of a number of different possible ways based on each producer's share of the total domestic-consumption allotment. Thus, the producer would receive only the current market price for the portion of his commodity that went for export, but a higher effective

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price for the portion that entered domestic consumption. This device closely resembles the original A. A. A. processing tax with benefit payments.

Tax Method and Price Fixing by Law

The third possible means of obtaining higher domestic than export prices is by means of a tax on domestic consumption. Such a tax, applied to appropriate commodities such as wheat and cotton, would raise the price paid by domestic consumers and would therefore limit the quantities consumed domestically. This, in turn, would throw a larger proportion of the supply upon export markets and would lower the price received for the exported portion, which would be the prevailing market price. The funds collected from the tax would be distributed to producers. This could be done either on the basis of current sales or on the basis of a domestic allotment, as under the original Agricultural Adjustment Act.

The fourth possible way of maintaining a two-price system for exported commodities would be to fix the domestic price by law at some point higher than the world price. Since this price would be higher than that which otherwise would prevail, less of the commodity would go into domestic consumption, and more would remain for export. As in the other cases, the prevailing market price for the exported portion would be reduced, and there would be an increase in the quantity actually exported. The results would be similar to those from any one of the three methods previously discussed.

Extremely complicated provisions would be necessary, however, in order to enforce the fixed domestic price. The cost of such operations would be very great. The plan would be likely to break down eventually, with little or no ultimate benefit to producers. Meantime, it would involve many inconveniences to consumers and marketing agencies. There would be a temptation to apply it to commodities not amenable to any form of two-price system. Certain products, because of the character of the demand, would be hurt rather than helped. Outright domestic price fixing can result in any event in no more benefit to producers than other two-price arrangements. Some proposed plans for domestic price fixing would materially reduce the incomes of the farmers and inflict needless hardship on consumers and businessmen.

It would be possible under any of the above plans to supplement the increased amount obtained from domestic consumers by funds taken from the Treasury. On the other hand, any of the plans could be made self-financing by means of a tax on domestic consumption or its equivalent as in the form of processing certificates. Temporarily, the Congress has appropriated large funds from the Treasury for agriculture. It cannot be expected to continue doing so indefinitely. Price-supporting measures must be financed independently of the Treasury if they are to continue in operation. Perhaps the best method is the processing tax on domestic consumption. Besides financing price-supporting measures, it constitutes by itself

a two-price system. It gives farmers the benefits of an American market, and yet does not unduly hinder their foreign trade.

Administrative Flexibility Essential

The manner in which any of these two-price plans is applied will greatly affect the results. There is a certain balance between domestic consumption and exports, and between domestic prices and export prices which gives maximum benefit. It would be easy, however, to fix arbitrarily the terms of the authorizing legislation in such a manner as to make this optimum balance unattainable. Unwise fixing of the terms and conditions under which the plan must be applied would produce adverse effects on the incomes of producers. Regardless of which, if any, of these plans is adopted, administrative flexibility in the application is essential.

Needless to say, the consumer also has a great interest in the problem. This interest must not be neglected. Any scheme for applying a two-price system to exported commodities constitutes a subsidy to foreign consumers as well as to American farmers. It involves expense to consumers in the United States. Foreign countries, including those whose trade policies hamper our export trade, would be permitted under the two-price system to buy foodstuffs and industrial raw materials from the United States at reduced prices, made possible by higher prices to our own consumers. Consumers well able to pay these higher prices and those not so able to pay them would contribute equally to the subsidy. Any resulting hardship would demand correction. In a sense, the food-stamp plan is a kind of domestic two-price arrangement. Obviously, to the extent that it is practicable, the domestic two-price arrangement is preferable to the other kind.

Two important points should be kept in mind. (1) None of these plans by itself can do much to improve the agricultural situation or to increase greatly the total income of farmers. It may apply well enough to one commodity and not at all to another. An agricultural program should not depend entirely on one expedient but should utilize various methods. Any scheme that pretends to be a panacea is almost certain to disappoint. (2) If farm incomes are to be raised, preferably the increase should come from a general increase in the income of all consumers. The permanent basis of farm improvement is increased balanced production simultaneously in town and country. Meantime, the increase must come out of Federal taxpayers, or from consumers in general.

THE INVESTMENT APPROACH

Many aspects of our farm problem can be traced in some degree to two basic difficulties that are rooted in the industrial depression. One is the fact that the balance between rural and urban population to which we were accustomed in previous decades has been altered. The other is the fact that consumers have insufficient buying power. These two difficulties are interrelated.

The persistence of inadequate incomes and unemployment in the cities and the lack of markets for all the output of the labor and machine power now engaged in agriculture emphasize the fact that we must deal with the agricultural problem in more than money terms. Surplus population living meagerly and idly on the land, along with unemployment and slums in the cities, poses many social as well as many economic questions.

One of the basic questions is the proper balance in our total population between agriculture and industry. The rapid rate of our industrial growth in previous decades served to postpone serious consideration of this question.

Decade after decade our urban population grew faster than the rural, and the proportion of the total population living on farms declined gradually to about one-fourth by 1930. Sooner or later, it might have been expected the decline would naturally taper off, but this event has come upon us abruptly. In a sense, the question as to what is the proper balance between farming and other occupations is at the moment academic, for the prevalence of unemployment in the cities means that nonagricultural industries have a major task of giving full employment to the nonfarm population before they take on the task of giving jobs to surplus farm labor. It also means that the task in agriculture is fast becoming one of dealing not only with the soil and with markets, prices, and income, but also with people who are in great need of jobs either on the land or on rural works programs or on both, if we are to have among them better conditions of health and greater social responsibility and economic productivity.

The decade of the 1930's was the first in our history that failed to show a declining proportion of the total population living on farms and of the working population engaged in agriculture. Among the factors responsible for this situation are the shutting off of foreign immigration, a decline in the birth rate, and the scarcity of industrial opportunities for rural migration to towns and cities. It is variously estimated that had the progress of industrialization continued during the 1930's as in previous decades, we would now have perhaps as much as 20 percent fewer people living and working on farms.

The Changing Economy

Here in striking form we have an illustration of the fact that the national economy has changed. Already it is far different from what it used to be. Adjustments of the kind that used to take place between agriculture and industry take place no longer, or at any rate not to an extent sufficient to reestablish a satisfactory balance. Obviously, if the annual farm income had to be distributed over only, for example, 26,000,000 persons instead of 32,000,000, the average standard of living in the rural areas would be about 25 percent higher. If the excess farm population could enter industrial employment and migrate to urban centers, the resulting increase in the demand for farm products would mean a gain in the farm income; but this route to a solution of the farm problem is not now feasible,

even if from the long-time consideration of economic and social health such a shift were desirable.

Surplus farm population is most abundant in a few areas that produce largely for export—in the cotton and wheat areas and in certain sections of the Appalachian region. Cotton farmers are struggling to regain an export market that formerly took 8,000,000 bales or more annually; in the fiscal year 1939, under exceptional conditions, it took only about 3,500,000 bales. Cotton yields per acre have increased in recent years. Cotton farmers can now produce on the average about half a bale an acre, as compared with about one-third of a bale in the 10-year period 1924–33. They can meet the demand with less labor than was necessary formerly.

On some 25 to 26 million acres, with normal yields, the cotton farmers could satisfy a domestic demand for 7 million bales and a foreign demand for 5 million bales annually. Even if the export demand increased to 8 or 9 million bales, only 30 million acres in cotton would be necessary. In the next few years, because the Government has large stocks of cotton on hand and because of increased yields per acre, it is unlikely that we shall need to plant as much as 30 million acres of cotton. Ten years ago the cotton acreage was 40 to 45 million acres. The combination of high yields, more machinery in production, and reduced net demand has resulted in serious overpopulation in cotton agriculture.

Similar things can be said of wheat. With average yields on the recent average acreage, wheat growers can produce close to a billion bushels annually. The domestic market requires less than 700 million bushels. This leaves 300 million bushels for export. Last year, however, the export market, even with substantial export subsidies, took less than 110 million bushels of United States wheat. In wheat, as in cotton, we can produce sufficient wheat for normal domestic consumption and for the current normal export demand as well with far less manpower. Illustrative of the human problem involved, it may be said that without letting the production fall below the demand, wheat and cotton combined could get along with 1.5 million fewer working persons. Present prospects for domestic and foreign takings, with allowance for the possible effects of the war, will not solve it.

In other agricultural areas the problem is not excess productive capacity in relation to possible market outlets but rather one of people living inadequately from every standpoint in unproductive and socially corroding surroundings. Some of these are the areas close to industrial centers where industrial depressions and the shifting of industries have left people to seek security on the land. These are the areas where families barely scratch a subsistence out of depleted soil, where hillsides have been denuded and consequently eroded, and where depleted soil fertility spells also erosion in home and family.

Per Capita Farm Income

To make the agricultural programs now in progress more effective, it is clear that we need a vigorous restoration in industrial activity—

a recovery that will be more permanent than that now being stimulated by war. Much of the progress we make in establishing parity income for agriculture depends on the industrial part of our economy.

The per capita income from farm production available for family living falls short by some $2,000,000,000 annually of being in line with the per capita income of the rest of the population. This estimate takes the pre-war relationship as the basis. Government payments to farmers for various purposes make up only about one-third of the discrepancy. The relationship to the pre-war parity could be restored in several ways: (1) By enabling the average consumer to increase the proportion in his budget of his expenditure for food and clothing materials; (2) by increasing the incomes and consumption of consumers whose consumption is below the average; and (3) by increasing the share of the consumer's dollar that goes to the farmers and reducing the share that goes for distribution. It is important, of course, not merely to increase the farmer's money share of the national income but to increase his actual command of city goods and services. This necessitates closing the gap between the prices of industrial products and the prices of farm products. Industrial products are now (October) about 22 percent above their pre-war levels while farm prices are about 3 percent below.

These different ways of alleviating the condition of the farmers all require greater industrial recovery and fuller employment in the cities. They call for a fuller use of available capital in job-creating enterprises. This is the surest way, indeed the only permanent way, to increase the purchasing power of consumers. Full industrial recovery would again draw into industries some of the rural people formerly employed in cities. Hence, while increasing the income of consumers, it would tend to diminish the number of claimants upon the farm income. What full industrial recovery requires can be judged from the current unemployment statistics.

In all occupations other than agriculture about 35 million people are now employed. There are probably at least 7 million unemployed, including persons on relief and persons normally unemployable. There are about 5 to 6 million more unemployed than there were in 1929. Full employment of all these people along with the continued employment of those already in jobs would require an increase of about 50 percent in industrial activity above the level of the summer of 1939 and about 25 percent above the present level. Such an increase would give us a national income of 85 to 90 billion dollars, as compared with the expected national income in 1939 of only 68 billion dollars. The same proposition can be stated in reverse. If we had a national income of 85 to 90 billion dollars, it would mean enough purchasing power in the hands of consumers to cause 50 percent more goods to be produced and to give jobs to practically all the urban unemployed.

National Income and Investment

There is a close relationship between investment in durable goods and the national income. Such investment, as it produces industrial activity and employment, promotes the general circulation of goods

and services, and increases the total of money payments. Such investment comes from past and current profits and savings, and from credit based on past and prospective earnings. Much more capital is available from these sources at present than is being used. When private industry fails to use its savings, with the customary superstructure of credit, as a means of creating new industrial activity and employment, the responsibility of the Government increases. It has to make investment itself in about the same proportion that private industry fails to make investments.

In one way or another the Nation's savings must be used in job-creating investments. In other words, they must be used, with associated expansion of credit, either by private industries or by the Government. There is normally some Government investment along with private investment. In times of economic crisis or depression, when private investment falls seriously below its norm, Government investment increases of necessity, either through relief payments for the conservation of human resources or through public works. It should be borne in mind that private capital does not permanently relieve itself of labor costs through unemployment, since the resulting need for relief payments requires increased taxation. It is better economy for private capital to make investments with less than the customary expectation of profit than to remain idle and force the Government to become responsible for the revival of employment.

In 1929, when our national income was more than 80 billion dollars, capital expenditures for durable goods such as plant and equipment, housing, household goods, and automobiles amounted to about 25 billion dollars. Such job-creating expenditures in 1932, when the national income was only about 40 billion dollars, declined to about 8 billion dollars. In 1937, on the other hand, when the national income climbed up to about 70 billion dollars, capital expenditures for durable goods were 20 billion dollars. The difference in the capital-goods expenditures of 1937 and 1929 was reflected chiefly in the expenditures for housing and for new industrial plants. If in each of the categories the country had spent about 2.5 billion dollars more in 1937, the national income in that year would probably have equaled that of 1929. Capital expenditures of an additional 2.5 billion dollars for other items would have brought about full economic recovery.

Durable Goods Expenditures

In the past, annual changes of 1 billion dollars in the expenditures for durable goods have been associated with corresponding changes of from 2 to 2½ billion dollars in the national income. This correlation does not distinguish between cause and effect. It would be just as correct to say that in the past annual changes of from 2 to 2½ billion dollars in the national income have been accompanied by annual changes of a billion dollars in capital expenditures for durable goods. The influence is undoubtedly reciprocal. Increased income gives rise to increased employment and increased consumer expenditure. The controllable factor, however, is the expenditure, since the means to make it exist and can be used if investors so desire. Appropriate

stimulating measures should be taken either by private investors or by Government agencies or by both.

Shortages in capital expenditures stand out most clearly in housing and in plant expansion. It is in these lines, therefore, that special action is desirable. Consumers fail to purchase durable goods such as housing because their earnings are inadequate or because prices are too high. The obvious response is to sustain and increase consumer incomes and to lower housing costs by various means. The last session of Congress considered proposals to increase the flow of capital by means that would not increase the Federal debt, and debated specific suggestions for the use of more credit in housing, in road construction, and in rural electrification. Proposals of this nature will undoubtedly receive further consideration in Congress. The object in view is to fill the gap represented by unemployment. As already noted, this calls for about 50 percent more industrial activity. In other terms it calls for an increase of about 20 billion dollars in the national income and about 2 billion dollars in the income from farm production.

A Threefold Problem

Perhaps we can divide the problem into three connected parts. One part concerns the problem of urban unemployment, which can be relieved only in part by relief expenditures and relief work. It is necessary also to have job-creating expenditures either by private capital or by public agencies, or by both.

The second part of the difficulty affects what we might term the permanent farm population—in other words, the 80 percent of the existing farm population that can produce what the market requires of foods and fibers. Measures for increasing the income of this group include crop adjustment and price and income payments under various Federal laws.

The third part of the general problem is the surplus farm population, with which group we should perhaps associate a hybrid group that is neither permanently industrial nor permanently agricultural. For these people likewise we need job-creating programs. Economic planning for this group is as urgently necessary as similar planning for commercial farming and for industrial expansion.

Specifically, it is necessary to develop for it various rural work programs which rural people themselves can devise, direct, and execute. A rural works program can be an important contribution to the economic rehabilitation, economic growth, and economic security of the surplus agricultural and industrial population.

NATIONAL INCOME AND THE RURAL-URBAN BALANCE

The condition of our country is reflected in the figures for the national income. From a high level of about 80 billions in 1929, our national income fell to about 40 billions in 1932. The recovery measures taken under the leadership of President Roosevelt helped to restore the total to a point three-quarters of the way back to the 1929 level. The national income reached 70 billions in 1937 and fell below 65 billions in 1938. This year the total may be around

70 billions once more. But the population now is 8 percent greater than it was in 1929, and in order to have a flow of wealth equal to what we had in the 1920's, our national income ought to be about 90 billions. Even that figure is less than the income we ought to have, considering our national resources and our technical progress.

What would it mean to the workers in our cities and to the people on our farms if we had a national income of not less than 100 billion dollars? Studies have shown that 67 percent of the national income is paid out in wages and salaries. Hence, nearly 25 billion dollars more would be going into the pockets of city workers. That would be good for agriculture; for out of every dollar that the wage earner gets, 30 cents goes to the grocer and butcher for food. An increase of 35 billions in the national income would mean an increase of 7 billion dollars expended for food at retail. Of this amount, farmers would get about half. Raising the national income to 100 billion dollars would put 3½ billion dollars more money into the farmers' pockets than they received in 1938. It would add around 450 million dollars to the incomes of the Corn Belt hog producers.

What are the requisites of a sound approach to a 100-billion-dollar national income? The first is balance. A full and free exchange of goods and services requires what might be called a progressive or continuing balance between the price and wage and production policies of industry and agriculture. If farm prices fall while city wages and prices stay up, farmers are forced out of the market for what city people make and city unemployment follows. If prices and profits of manufactured products rise faster than wages and farm incomes, or if the prices of manufactured products are maintained while their production is curtailed, business goes into a decline. There is trouble if wages rise above the levels justified by prices. Wages, prices, and production must be kept in step.

Balance in the Flow of Capital

Balance is important also with reference to the flow of capital. This applies to the investment and spending policies of both business and Government. Life insurance companies, railroads, power companies, other public utilities, and industrial and financial corporations all affect the course of business and the flow of national income by what they do in investment and spending. When they float stocks or bonds or utilize financial reserves to invest in new capital goods, the investment of Government capital can be held to a minimum. When all the corporations stop spending or investing, Government capital must fill the breach.

Closely related to the question of a balanced flow of capital is the question of balance in credit policies. The flow of capital involves the flow of credit, and credit means debt. Credit is involved also in the flow of goods to consumers. Installment selling, properly used, is valuable in facilitating this flow. But if installment selling is used to excess, and consumers' wages and salaries are mortgaged too far ahead, business assumes a pace that cannot be maintained. Balance is important also in foreign trade. We cannot export unless we also import.

It is just as important for the Government to follow stable and well-considered spending and investment policies for productive and social purposes as for private business to do so. Government activities ought not to be suddenly curtailed without regard to the effect on the course of business. Budget considerations, however, make it impossible for Government to match in full the outlays that private business normally makes.

Hence, it is important to encourage private capital and get it flowing. Agriculture, industry, labor, and Government can surely agree on these principles. We must maintain Government activity as long as it is necessary, and we must encourage private capital to go back to work. That is the only sound way to get an increase in business activity and national income that will increase Government revenues, decrease Government expenditures, and balance the Budget.

Basis for Rural-Urban Cooperation

When we ask how business, labor, and farmers can cooperate for increased national income we must face facts as they are. There are many seeming conflicts between the interests of labor, industry, and agriculture, as well as conflicts between various elements within each of these three great groups. The first step in resolving these conflicts is a recognition that progress can be made through the democratic method of setting commonly shared objectives. How business, labor, and farmers can work together so that they may develop harmonious price and production policies, is a problem in practical democracy.

Economically there is a solid basis for community of interests between farmers and city workers. City employment depends in part on the ability of farmers to buy, while prices of farm products depend in part on the ability of city workers to buy. This interdependence appears in many ways. Cash farm income and total factory pay rolls rise and fall together. Sales of rural retail stores and mail-order houses are business barometers and go up and down with the farm income. Rising farm buying power, as reflected in these indexes and in auto sales in farm districts, led recovery after 1932. In 1938, despite a great drop in industrial activity, cash farm income dropped only 13 percent below 1937, and the sustained buying power of the farmers was a factor in starting a new upturn in 1939.

Ordinarily there is a constant flow of farm boys and girls into industrial jobs. Farmers rear more children than can find places in agriculture. In the decade of the twenties, about 40 percent of the farm-reared boys and girls moved into towns and cities; since then urban depression has kept large numbers of these young farm folks on the farm, where they are not needed. Full city employment would provide work and livelihoods for these farm sons and daughters, as well as an increased market for the food and clothing produced by their parents. Expansion of industrial employment and absorption of the rural unemployed in industry are the only real and lasting solution for the problem of overpopulated rural slums, for the problem of misdirected migration, and for the problem of

technological unemployment in agriculture, in which farm hands and tenants are being squeezed out by the increase of general-purpose tractors in the Midwest and Southwest.

Farmers and city workers have a common interest in programs of action for full employment and balanced production both industrial and agricultural. True, there are situations where farmers and city workers find their short-time interests opposed. Labor groups occasionally organize boycotts on beef because the price seems high, without stopping to determine whether farmers' actions or drought was the cause. Farmers sometimes oppose wage-and-hour laws without considering their effect on employment, because they fear that such laws will raise the prices of what they buy and indirectly raise the wages they pay hired labor. Farmers have been known to break up strikes in canneries or other processing plants, without stopping to inquire what justification there was for the strikers' demands. Labor groups have supported progressive farm legislation over the last 20 years more consistently than farm groups have supported labor legislation. Both need to remember that no group can expect to sell dear and buy cheap for very long if direct farmer-labor conflicts are to be avoided.

Ways to Prevent Conflicts

Harmonious working agreements and understandings should be developed ahead of time between farmers and industrial workers, so that such antagonism can be prevented. Fortunately, the process of developing them has begun. For example, the Farmers' Union and the Agricultural Workers' Union, in recent negotiations concerning employment contracts in the sugar-beet area accorded sensible considerations to each other. Representatives of these two groups averted what might have been serious economic and social difficulties in the beet fields. In an agreement reached in October 1938, in Denver, Colo., they agreed to consult each other and to consider the interests of each other. As a result, beet farmers who observe the agreement are protected at harvesttime from labor difficulties, and sugar-beet field workers are assured of better working conditions.

In order to bring about a better understanding permanently between farmers and industrial workers, it is particularly necessary to raise the living conditions, not only of the commercial farmers, but also of the farm tenants, croppers, heavily mortgaged owners, and farm laborers. Higher levels of income for these groups will protect the wage levels of the lower income groups in industry. Our general farm programs aim to raise and stabilize income of all farmers, and in addition to give specific help to the submerged small farmers, tenants, and laborers.

The rural rehabilitation program, by providing loans, leadership, and farm and home guidance, aids submerged farm families to become self-supporting. More than 600,000 families, or one-tenth of all the farm families of the country, have been helped in this way. Direct grants have been made to an additional half million farm

families in areas stricken by droughts, floods, and other disasters. Some 17,000 tenants have been started toward ownership through the purchase of farms under long-time methods of payment at low interest. Farm laborers have been helped through the fixing of wages in the beet and sugarcane fields at reasonable levels under the Sugar Act, through development of better working conditions in areas affected by Farm Security Administration operations, and through aid to transient laborers on the Pacific coast. Grants to thousands of transient families have provided essential medical care, and many transient workers' camps have been built. Camps now in operation can accommodate 2,500 families at one time; camps being constructed or planned will triple this capacity.

Meetings between farm leaders, labor leaders, and business leaders may promote a better rural-urban understanding. Questions such as the interest of farmers and labor in the price and production policies of industry, the interest of farmers and industry in the wage and hour policies of labor, and what agriculture, industry, and labor can do to maintain stability of production and employment at a high level can be discussed. Each group's objectives and points of view and the points of agreement and conflict can be clarified.

Most farmers, though they work for themselves and take business risks, nevertheless sell their own and their family's labor. Moreover, they sell this labor in the form of farm products at a price per hour far below that received by city workers. Only one farmer out of seven has any hired help at all; many of that one-seventh hire only a few days' help at harvesttime. Cotton at 8 cents a pound actually means 5 cents an hour for their labor to the farmers on hundreds of thousands of farms. Farmers are not only small businessmen; they are laborers as well. They have little to gain by supporting either monopolistic industrial employers or groups of monopolistic employees who unduly restrict production. They have much to gain from cooperating with industrial workers and with enlightened industrial management for larger consumption and larger national income.

Mutual Adjustment of Production

Farmers and city workers can get together also in developing means whereby each can assure the other of an ample and continuous supply of products. Farmers have already made much progress in this direction. They have always maintained their production with little curtailment, even in periods of very discouraging prices. Under the ever-normal-granary system, as embodied in the Farm Act of 1938, they obligate themselves to build up and maintain more adequate reserves than in the past. The act bases all farm-production programs on previous acreage consumption plus storage and export needs, and thus city consumers are assured full supplies. If we should again have a great crop failure, such as we had in 1934 and again in 1936, consumers could still count on practically normal supplies of wheat, hogs, and beef. Crop-loan and crop-insurance phases of the plan protect farmers to some extent against unduly low prices

National farm programs have gone still further to make certain that no one goes hungry. Through the Federal Surplus Relief Corporation, and subsequently through the Surplus Commodities Corporation, the Government has purchased large quantities of surplus products for relief distribution. Much of the money annually appropriated by Congress for widening the market for farm products has been used in this way. The list of products thus purchased and distributed includes butter, evaporated milk, grapefruit, apples, rice, corn meal, beans, cabbage, canned tomatoes, peaches, dried peas, prunes, wheat, eggs, potatoes, and cotton.

These purchases have lessened the pressure of particular surplus supplies and have helped families on relief. Protective foods, such as dried skim milk, citrus fruits, dairy products, and eggs have been especially stressed in these programs. The distribution of dried skim milk, which is of especial value in combating deficiency diseases, has involved the development of new methods of packaging, new cereal mixtures, and much consumer education. As a result, a wholly new food product has been made familiar to those with low incomes, and an important dietary deficiency has begun to be corrected. The cooperation of the Works Progress Administration and of State relief agencies in handling the packaging and distribution of these products has been an essential part of the program.

The fundamental and persistent need is for full production and full employment. Our objective must be to develop workable and effective means of reaching and maintaining a full and balanced prosperity on farms and in cities. It is not the function of the Department of Agriculture to suggest how the industrial part of this problem might be solved, but it may properly emphasize the fact that its own programs need an industrial counterpart. If industrial labor and management can find ways to work together for increased production and consumption, farmers are in position to cooperate with them fully for general balanced and full production.

PROGRESS AND PROBLEMS OF FARM TECHNOLOGY

Technical progress in agriculture and industry, which for centuries was very slow and indeed absent for long stretches of time, has been rapid during the last 150 years. In this same period the world's population has expanded greatly, doubtless as a result, in part, of man's increased technical power. Whether or not the march of technical progress will stop, we cannot tell. Stagnation, however, does not seem imminent. More probably, technical progress will continue to be rapid. On the other hand, growth of population probably will not. As far as we can see now, the rates of population growth both in North America and in Europe will decline, and the rough balance that has existed heretofore between technical progress and the growth of the market will not endure.

Needless to say, technical progress in both agriculture and industry enables fewer people to produce the commodities for which available buying power exists. Agriculture, with vastly more manpower than the commercial market for agricultural products requires, finds itself

in a serious dilemma. It cannot turn its surplus people over to the cities, since urban technology is likewise displacing labor. Urban industry continually increases its output without a proportionate increase in its employed labor. Indeed, technical progress in industry, since it usually goes along with high concentration of industrial control, may emphasize the cost-reduction features of technical improvement rather than the power such improvement gives to increase the physical output of old or new commodities. Leaders in industry frequently discriminate between technical improvements that tend to yield immediate profit, and improvements that may not offer immediate profit or may even affect profits adversely. In other words, they often favor improvements that save labor more than those that increase the available supply of goods and services.

In a purely competitive system advancing industrial technology would constantly provide new openings for investment and new jobs for displaced workers. It would not freeze or check the development of new-product opportunities, as the existing set-up does so frequently. In proportion as it caused unemployment in some lines it would create compensating new employment in other lines. In other words, it would not save labor merely for the scrap heap. Obviously, the day of vigorous industrial competition is passing and is giving place to a day of highly concentrated and even monopolistic control. The problem is to harmonize this change with the urgent need of increased employment and production. Briefly, the job is to make technical progress create and not destroy jobs.

In an economy such as we now have and such as we are likely to have for many years, with a relatively stationary population and with high capital investment in existing production machinery, the fate of rural and urban labor cannot be left entirely to the conditions of the market place. Society, as well as the individual entrepreneur in industry or in agriculture, has an interest in the effects of technical progress on employment conditions. It is well known that industrial leaders often feel obliged to check the adoption of improved technical devices or methods so as to protect in some degree the value of their existing investments. For example, control has been exerted over the rate of introduction of the French telephone, an instrument much superior to the best type of telephone previously available. If the telephone business were an affair of small competing concerns, this improvement might have been introduced more rapidly. When technology retards employment, it becomes a public problem.

Farm Technology Unhindered

In the instance of the telephone the social interest appears to have been protected, but many instances could be cited to the contrary—instances in which the monopoly control of invention has been socially harmful. It is noteworthy, moreover, that such control is the exclusive prerogative of urban industry and has no counterpart in agriculture. There is no conscious or deliberate control of the rate of introducing or adopting new devices on the part of farmers. Once agriculture has demonstrated the effectiveness of a new tractor, a new plant vari-

ety, or a new remedy for plant diseases or plant pests, the use of the improvement spreads rapidly. The disparity between the controlled use of technical improvement in industry and the uncontrolled use of it in agriculture has a very important bearing on the rural-urban balance.

Nevertheless, certain natural limitations attend the adoption of new agricultural devices. Agriculture, because of the biological character of its work, cannot greatly modify the timing of growth processes. It is impossible in agriculture quickly to step up the output of some product 40 or 50 percent, as may sometimes be done in urban industry. Even hybrid corn, the most outstanding recent development, gives as yet no more than a 10- or 15-percent increase in the yield per acre. The incentive to adopt new devices is often less strong in agriculture than in industry, and this fact, along with lack of knowledge among the farmers as to the usefulness of new improvements, may retard the adoption rate. The lack of funds to buy improvements is, of course, another retarding influence. Even so, the rate of technological improvement in agriculture is very rapid. One estimate is that from 1870 to 1930 the average output per agricultural worker in the United States increased about 140 percent as compared with an estimated increase of 155 percent per worker in mining and manufacturing in the same period.

Another estimate, covering the period from 1919 to 1938 for agriculture, puts the increase in production per agricultural worker at about 20 percent. As an indication of the comparison with industry, we may take the figures for 59 manufacturing industries for the period 1919–36. The output per wage earner in these industries increased about 45 percent. On the basis of these figures solely, it would seem that the technological advance has been greater in the urban field. It is necessary to make allowance, however, for the fact that technical progress in agriculture, though it reduces the manpower requirement, does not always proportionately reduce the farm personnel. Many men stay on the farms though their labor may not be needed there. Had all the people left the farms whose labor might have been dispensed with, the indicated increase in production per farm worker would be higher. Moreover, agriculture absorbs part of the labor released by its gains in efficiency and employs them in intensive operations such as dairying and truck growing. Significant recent shifts have been toward these types of farming.

Farm Manpower Release

Yet the release of labor from agriculture through technical improvement is normally very large. Between 1870 and 1930 the proportion of gainful workers 10 years old and over engaged in agriculture dropped from 53.8 to 22 percent. Urban industry employed the released rural manpower and used it along with technical improvements to increase the physical volume of its output per capita by about 350 percent. Industry is the traditional absorber of surplus agricultural population; and the operation is socially beneficial, since it increases both the urban production and the urban market for agricultural

commodities. It maintains a working balance between agriculture and industry, in which each can buy the products of the other. After the World War, however, important changes took place in the rural-urban balance. The total national output increased about 45 percent between 1920 and 1930; yet the labor force employed increased only about 15 percent. In agriculture the total output during this period increased about 10 percent, with practically no change in agricultural employment.

In other words, the post-war decade showed a warped development. Production increased faster than employment both in the factories and on the farms; but the growing spread between production and employment was wider in the cities. Moreover, it was not the result exclusively of relatively greater technical progress in the urban industries. Management and organizational changes especially promoted the adoption of labor-saving types of innovation, particularly in industries under highly concentrated control. Innovations capable of developing new products did not have full rein. With respect to new products, there was considerable economic birth control. In this way industrial technology created unemployment.

After the crisis of 1929, the relative displacement of manpower by machinery increased. As a result, industry practically ceased to take surplus manpower from agriculture and instead looked toward the land for a refuge for some of its own unemployed. If the technical advances in industry as measured by output per worker had been slower in the first post-war decade, the ensuing unemployment situation might have been less acute. From the standpoint of agriculture, the situation presented the double handicap of a declining market for farm products and a declining opportunity to place surplus farm manpower in nonfarm occupations. Never before had agriculture met with a similar difficulty.

Direct Impact of Technology

Let us turn now to the direct impact of technology on agriculture. Technical improvements in agriculture have two main kinds of immediate effect. The first effect is mechanization and the saving of labor. It reduces the labor requirement in agriculture, yet often without greatly increasing the total production. In fact, the adoption of labor-saving machinery may not increase the total production very much, unless it brings new land into agriculture. Mechanical improvements are less likely to affect the total farm production in the future than they have done in the past, since our large areas of virgin land have all been taken up.

Mainly farm technology affects farm labor. The number of workers employed on farms in 1938 was only 95 percent of the number employed during the period 1924–29. Mainly the decrease, which amounted to 600,000, was in hired workers. Mechanization often enables family workers on farms, who are three times as numerous as hired workers, to enjoy increased leisure. True, mechanization increases the demand among young farm people for nonfarm jobs, and in some sections it promotes farm consolidation with the consequent

need to relocate some farm families. Nevertheless, technological improvement causes less displacement of personnel in agriculture than in industry. Because of the large proportion of family workers on farms, the benefits of increased leisure from improved methods tend to be widely shared. Even on hired labor the impact of technical change, though very great at present, is probably less drastic in agriculture than in industry.

Yet tractor power for farm work and automobiles and trucks for hauling and travel have greatly increased the capacity of labor on farms. The natural adjustment is to increase the size of the family farm business and to reduce the need for extra labor. Greater power and improved machine design facilitate better seedbed preparation, more thorough tillage, and less loss in harvest. They reduce the land, as well as the labor, requirement. Such gains, with a proper balance of equipment to land area, may require little or no additional working capital on a given area. Motor power on farms has brought almost revolutionary changes to the wheat- and corn-producing areas and promises further adjustments in these and other areas in the immediate future. With associated changes in the organization and use of farm labor and capital, it may cause yet further shifts of producing areas, further changes in size of units, and further displacement of laborers.

Between 1930 and 1939 the number of tractors on farms nearly doubled, despite low farm incomes during the early years of the period. Changes in design increased tremendously the usefulness of the all-purpose tractor. Adapted for use on smaller farms, the small tractor and corresponding equipment jumped to wide popularity. In some areas they retarded the movement to enlarge the size of farms. Where small farms predominate, however, the tractor will probably introduce changes in farm organization similar to those initiated by the two- and three-plow tractors in the Central and Western States.

Between 1915 and 1939 motor equipment displaced nearly 10,000,000 horses and mules on farms. This displacement released the production of some 30,000,000 acres of cropland and 15,000,000 acres of pasture, either for direct sale or for the feeding of other livestock. With flexible motor-power units and pneumatic tires on tractors and equipment, the motor can take over more and more of the farm work. Only drastic reductions in farm income to a level comparable with that obtained in 1932 can arrest the trend. Adjustments may take place more slowly than in the past, but a further reduction of 1,500,000 work stock and the release to commercial uses of the products of 6,000,000 additional acres of cropland and half as much pasture is a probability for the near future.

Use of Harvesting Improvements

The combined harvester-thresher, which reduces the job of cutting, shocking, hauling, or stacking, and threshing small grains to a single operation, has practically eliminated the need for extra harvest hands in the grain-producing areas. Combines adapted for use on small

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acreages and for a variety of grains and seeds reduce the need for seasonally hired workers in other areas. In the Corn Belt the mechanical corn picker has displaced many fall workers. Labor displacement on a large scale in the Southern States would probably follow the improvement and adoption of a mechanical cotton picker. This development, however, may be delayed since it depends in part on the parallel development of varieties of cotton which ripen more evenly and are capable of being harvested in one operation.

Even without the mechanical picker, economies in cotton growing can be achieved through the use of large machinery. In one area the proportion of cotton worked with wage labor shifted from 30 percent of the acreage in 1933 to 47 percent in 1936. The proportion worked with share labor dropped from 52 to 43 percent in the same period. Although the change does not necessarily mean a proportionate reduction of laborers, some displacement of families may result. In another area of the Cotton Belt on a group of plantations partly mechanized since 1932, the number of worker families for each 10,000 acres of cropland dropped from 418 to 327. Here, as a result of cotton-acreage reduction, a shift to crops using less labor per acre, and the use of mechanical power, 22 percent of the families on the land were displaced in the course of a 7-year period.

Even with an increased cotton acreage, mechanization and the accompanying efficiencies will release many cotton workers. Displacement of farm operators through farm consolidations may occur also. For example, in a study of cotton production in the High Plains cotton area in Texas, it was shown that if all farmers used two-row tractor equipment the land farmed in 1934 could have been operated with only 58 percent of the farmers actually reported by the census in 1935. If all farmers used four-row equipment, only 33 percent of the farmers reported by the census would have been needed to operate the same area. Suppose the cotton picker does not come into use in the near future and suppose further that some workers not retained on farms find part-time work chopping and picking cotton, it will still be necessary to find other places in our economic system for an increasing number of workers displaced from agriculture in the Southern States.

Yields and Livestock Production

The other main influence of technical improvement in agriculture relates to crop yields and livestock production. It may increase the output per acre considerably and may emphasize the need for cooperative crop adjustments. Tractors and other large machinery work best in the larger and more level fields; other technical improvements benefit all farms regardless of their size, lay-out, or topography. Improved varieties of crops and improved methods of feeding or handling livestock are open to large and small farmers alike. Generally, technical progress enhances differences in farm opportunities and in individual farm incomes, and gives an advantage to the farmers with good-sized farms and adequate working capital. Such farmers can profit better than the rest from the nonmechanical as

well as the mechanical aspects of technical improvement, since they are in a better position to obtain improved seed, improved varieties, and proper fertilizer materials. Nevertheless, the relative significance of the nonmechanical developments appears to be increasing, and the fact has some equalizing influence as between the highly commercial and the less commercial farmers.

Hybrid corn and tame hay are examples of great current significance. Starting from zero in 1929-33, hybrid corn in 1939 had covered 40 percent of the total acreage in the Corn Belt, and, as already noted, had increased the average yield substantially. From the same base period the percentage of improved types of hay in the total tame-hay acreage increased enough by 1938 to raise the normal yield of all tame hay by 7 percent in the 12 Corn Belt States. It is estimated that by 1948 average Corn Belt yields of corn will have been raised between 15 and 20 percent as a result of hybrid corn, and tame-hay yields nearly if not quite as much as a result of improved types of hay. Prospective changes of such magnitude call for thought and action.

Mainly the problem of employing manpower displaced by agricultural technology lies outside agriculture. Fundamentally, it is an urban problem, because urban industry, by its nature, is capable of almost limitless expansion, while agricultural production encounters the limitations of the human stomach. In other words, the cure for the problem of technological unemployment in agriculture must be the same in the future as it has been in the past. It must be the absorption of redundant farm labor into industry. Perhaps the best short description of the agricultural crisis is that it is an interruption of the secular release of human energy from rural to urban occupations. The problem is to revive this transfusion of labor power. Nevertheless, because urban industry has difficulty at present in absorbing even its own displaced workers, it may be necessary to assist displaced farmers and farm laborers in establishing self-sufficing or subsistence farms. Some element of subsidy will be involved, and considerable farm and home guidance by Federal and State officials. Apparently, however, in the absence of a great industrial recovery there is no alternative. Certainly this procedure has more to recommend it than certain proposals that agriculture should copy industry in controlling the rate of technical improvement. From a broad social standpoint it is of course absurd to destroy the powers of production. It is infinitely better to let commercial agriculture develop its full technical powers, and to provide specially for rural groups that have no place there or elsewhere.

Expanding Uses of Farm Products

Much can be done to expand the uses of farm products. This is a problem in economics and sociology as well as in technique. Regional laboratories which the Department has set up will help to solve it. Exploring possible wider uses for farm products is often very enlightening. For example, fresh evaporated milk has been technically available for several years. Development of the market

for this product, however, seems to be delayed by economic resistance based on fear of the effect it may have on present fluid milksheds.

This product has actually been placed on the market in several western cities and has received a favorable response from consumers. It lacks the cooked taste of canned evaporated milk and appears to be nutritionally on a par with fresh whole milk. It has the advantage of reduced bulk and consequently of lower shipping and handling costs and also has better keeping quality. Above all, it can be sold at a much lower price; in fact, at a price well within the reach of low-income groups that do not now have enough milk in their diets. In short, the development of a market for fresh evaporated milk would increase the total volume of milk sold and provide more employment in the dairy industry.

Development of new products and new uses for old products requires definite measures to remove economic resistance among producers and distributors. Needless to say, the production and sale of new commodities may temporarily injure some established private interests, but the general interest should prevail above the private interest in such matters. Other cases like the fresh evaporated-milk example could be cited, in which economic resistance checked gains from technical progress. Among the measures that could be adopted to correct this difficulty, the food-stamp plan is significant. So far this plan has been limited to the disposal of surplus commodities. It could be extended, also, to commodities which may not be surplus commodities but which could be more largely used and which would improve the diet of those eligible to receive the food stamps.

THE SAPPING OF OUR LAND RESOURCES

The roots of American democracy go deep into a fertile soil. The richness of this land, its rewarding productivity, have for generations of Americans meant the opportunity, independence, and security that are at once the strength and promise of democracy. All that we have built on this continent in a century and a half of national life is built, fundamentally, on the goodness of our soil. That has been our great resource.

Paradoxically, of all our natural resources, it has also been the least considered. We took this continent in the most remarkable rush of agricultural occupation the world has ever known—peopled it, cleared it, plowed it, and erected the complex structure of a mighty nation in the span of 15 decades. We built fast and in many ways wisely. But with the land itself we were improvident.

As a result our vital soil supply is not secure. Across this country, under the pressure of economic need or because we knew no better, we have used the land unwisely, and soil, the living, productive part of the land, has steadily been going out. A hundred million acres of good cropland is ruined or seriously impoverished, according to the surveys of the Soil Conservation Service. Another 200 million acres, all of it good cropland, is either slightly harmed or threatened under its present use. Taking all land into account—cropland, range land, pasture land, and so on—a billion acres, half the land surface of the country, has felt the force of soil erosion in some degree.

Implicit in this wholesale sapping of our land resource is the serious threat to national security. Historically, land decline has been an early symptom of national decadence—there is evidence, in fact, to indicate that great civilizations of the past have died of the malady of land decay. This country, to be sure, is far from decadence. But the continuing deterioration of our land, with all its implications of lower living standards, curtailed agricultural opportunity, and other social and economic ills, is cause for grave concern and aggressive action.

This would be true under any circumstances. But in the present period of world unrest, with Europe dominated by the destruction psychology of war, land conservation in the United States is a matter of extraordinary importance. In such a time, our national stability is our greatest safeguard against involvement in the conflict, and our strongest bulwark against the almost certain aftermath of world-wide economic stress. It seems apparent that our first line of defense in the United States in the present emergency must be built around the resources which are the source of our national vitality and endurance.

It has been only a quarter of a century since, in response to the demands of the Great War, the United States engaged in a wholesale and disorderly expansion of its cultivated acreage. Some 40 million acres—much of it completely unsuited to the production of cash crops—went under the plow in a few years. The duststorms and blown-out fields of the southern Plains and the gullied hillsides of the South and Middle West are visible evidences of the damage that resulted. Many a field in the United States is as "war-torn" as any field of Flanders. Leadership and proper guidance in the mobilization of our agricultural resources in the last war would have prevented much of this destruction.

Progress in Land Rehabilitation

Since then, the work of land repair and rehabilitation has made much headway. In the last few years, the principles of conservation have been widely applied by our farmers. But no one will contest the power of the price incentive nor the possibility that wartime prices for our commodities may again induce our farmers to expand their cultivated land. It is essential in this present emergency to recall what happened 25 years ago and to provide the leadership that was lacking then. There is no reason why an expansion of acreage fully adequate to meet wartime demands for our crops cannot be brought about in an orderly and efficient way and with some thought of defending the land itself.

Such defensive action will require certain major readjustments in the economic and social patterns of our national life. Behind the purely physical causes of soil erosion—the cultivation and use of lands without regard for their natural adaptabilities to use by man—are forces that serve as a continuing incentive to unwise treatment of the land. The pressure of economic need which induces exploitation and impedes conservative handling of the land must be relieved if we are to have real conservation. Our land-tenure system must be

made to give tenants and sharecroppers some incentive to treat the land well. The problem of absentee ownership in the Great Plains, which frequently makes it impossible to bring large areas of critically affected land under conservative treatment and wise use, must be dealt with; rural communities stranded in areas of submarginal land must be rescued; and so on. These necessary economic and social adjustments must be made before it is possible to put the principles of conservation into practice with any measure of permanence on the great area now threatened by erosion.

In the last few years, the social machinery necessary to carry forward an extended conservation effort has begun to take definite form. Duststorms, floods, and other manifestations of the land problem have given impetus to the development of a program of democratic action in which the land users of the country and the Government are mutually helpful partners. In the past, public agencies relied principally upon research and education to solve the ills of agriculture. Today they are moving into the field and bringing the resources and facilities of the Government directly to the assistance of people living on the land.

Farmer-Government Alliance

There is a new working alliance between farmers and the Government which did not exist a few years ago. The land users of the country are building their own program of land use readjustment out of their own grass-root experience. Through county planning and advisory committees, soil-conservation districts, and similar local mechanisms, problems of land use are being studied and analyzed, action programs are being planned and carried out by farmers themselves with the help of public agencies especially equipped to assist them.

In the last 3 years, for example, 36 States have enacted legislation authorizing the formation of local cooperative land use organizations known as soil conservation districts. As of October 1, 1939, 187 districts had been formed. They cover an aggregate area of some 108 million acres of privately owned farm and grazing land in 27 States. These districts are formed voluntarily by groups of land operators for the specific purpose of readjusting and regulating land use practices in the best interests of the community. The process of formation and administration is democratic, with ample opportunity for the expression of majority will at every important stage. Stated simply, their function is to develop and help individual land operators to carry out a program of proper use for all the land within their boundaries. The district itself undertakes to carry out the work with the assistance of such public agencies as may be in a position to give help.

For example, Baca County, Colo., is in the heart of the wind-erosion sector of the southern High Plains. In March 1938, farmers in the western half of this county organized a soil-conservation district under the provisions of a law passed by the Colorado Legislature in that same month. Since 1932 these farmers had suffered greatly

from extreme drought, damaging duststorms, crop failures, and low prices. The result, as the farmer supervisors of the district put it, was "an enormous burden of relief, general discouragement, land abandonment, and migration."

Of the total area of the district, 413,085 acres, or nearly half, is owned by nonresidents, and at the beginning of 1938, 35 percent of the land in the district was tax-delinquent. The average farm unit in the district was 663 acres, and the net cash income per farm, including Government payments and subsidies, was less than $500. In fact Government payments were the main source of farm income in the county at the time the district was formed. One-fourth of the farm dwellings in the district were valued at less than $150; one-half of the houses at less than $300. Between 1920 and 1935, tenant-operated farms increased 311 percent.

As summed up by the supervisors of the district, the main causes of the land problem in the area were the uneconomic size of farm and ranch units; physical misuse of the land; a complex chattel-mortgage situation connected with the extension of credit largely by implement companies; exhaustion of livestock, feed, and financial resources as a result of drought; drastic decline in supplementary agricultural employment; low prices for farm products; and the burdens of taxation.

Between 1933 and 1937 more than $5,000,000, or about $486 per capita, of Federal money was expended in Baca County. "This large amount of money has been poured into the county without any definite plan or coordinated action," the supervisors pointed out.

> The accomplishments of these expenditures have been questioned in many instances; for example, it has been pointed out that the listing program in 1936 accomplished commendable results in getting a cover on much of the land in the county. Then the emergency seed loan in the autumn of that same year loaned money to farmers to tear up much of this cover and plant wheat * * * Practically all of the land in the county could have been purchased and complete control of land use been effected if the money had been expended in that direction. The local residents realize that the large uncoordinated expenditure of money was for emergency purposes. Acting on this realization, the soil-conservation district was formed to coordinate the expenditure of private and public money in the future.

Some of the more specific purposes of the district are: Control of soil erosion, establishment of economic farm and ranch units, adjustments in taxation, stabilization of land use, development of proper tenant and landlord relationships, arrangement of suitable agricultural credit, fostering of satisfactory home and community relationships. What has been done in the district since its organization is fairly typical of the role which such organizations are now performing or will perform throughout the country in cooperation with Government agencies.

The Soil Conservation Service, the Farm Security Administration, the Agricultural Adjustment Administration, the State extension service, and other State agencies are coordinating their activities in the county through the medium of the district board of supervisors. For example, one of the most serious land use problems in the county arises out of the fact that over half of the land is held in absentee ownership. The board of supervisors is now leasing as much as pos-

sible of this absentee-owned land and placing it under the program of the Agricultural Adjustment Administration. Payments from this agency, for conservation treatment of the land, are used as security for loans from the Farm Security Administration with which to carry out necessary soil-conservation work planned by technicians of the Soil Conservation Service. In this way, through the coordinate use of funds and services made available through three Federal agencies, the supervisors have found a method of coping with one of the most difficult land problems with which the people of that county are confronted.

Broad Cooperative Program

Assistance made available to farmers by the Farm Security Administration, by the Agricultural Adjustment Administration, and by the Soil Conservation Service is coordinated through the medium of the soil-conservation districts into what amounts to a much broader program than any one of these agencies is authorized to undertake individually. In developing a rounded program of land use the districts have the cooperation also of such agencies as the State extension service, the Bureau of Agricultural Economics, the State agricultural experiment stations, the Federal land bank, and other Federal and State agencies having a direct or indirect interest in the solution of land problems. In short the soil-conservation district is rapidly becoming an extremely important factor in coordinating the activities of various governmental agencies in their approach to the problems of a given area.

The activities of the Department most directly affecting the conservation of soil are administered by the Soil Conservation Service. Its work, since the recent reorganization of the Department's internal structure, has been expanded to include the whole field of physical adjustments in the use and treatment of the land, including the rearrangement of individual farm practices for the purpose of protecting the land from erosion, the treatment of large areas of publicly owned land for erosion control, the development of and prosecution of upland flood-control work, the purchase of submarginal land and its development for constructive and beneficial use, the advancement of farm forestry, and the development of water facilities necessary to support good land use practices in the arid and semiarid areas of the country.

These various activities are interlocking in the application to the solution of land use problems. Purchases of submarginal land, for example, are being used to obtain control of land in areas where the large proportion of land in absentee ownership makes it impossible to establish effective conservation practices. Likewise, submarginal land is being purchased with a view to enlarging farm and ranch units which are too small to provide an economic return under conservation practice, and to promoting flood control and watershed protection. The promotion of forestry as an integral part of the farm economy changes the use of land. Adequate facilities for stock water, irrigation, and water spreading in the West make it possible to correct abusive grazing practices, improve the range, and develop

certain areas for the production of crops. Combined into a single, integrated attack upon the diverse land use problems of an area or a region, the various programs make a well-rounded approach to the correction of the physical ills of the land.

THE PUBLIC INTEREST IN LAND USE PLANNING

In recent years our national land policy has broken sharply with the traditional principle and launched programs based on the idea that land utilization is a matter of public as well as of private concern. It has recognized and acted on the fact that certain economic maladjustments in the use of land can be corrected only by governmental action in cooperation with land users themselves. This is a change of tremendous magnitude and importance. Moreover, it has come to the attention of the public rather suddenly and has brought revolutionary changes in our conception of the problem. Nevertheless, it is not really a plant of sudden growth. On the contrary, its roots run far back in processes of economic and social change that have been the intensive study of land economists for more than a quarter of a century.

Social developments of this character, though often surprising, are never mushroom growths. They have their origin in the slow emergence of new conditions and problems—in such things as the pressure of population on resources; the balance or lack of balance between farm and city life; the relationship between commercial and noncommercial farming; the state of agriculture's market; the progress of farm technology; and the wastage of timber, grass, soil, and water. Farm ownership and farm tenancy are dynamic influences. Ownership of farms by the operating occupants comes easily in a virgin continent. It comes hard with the free or cheap land all gone and with population pressing onto poorer lands. Government procedure with the frontier closed cannot be what it was with the frontier open. Our new land policy is not an improvisation, but an inevitable and indeed tardy recognition of the fact that the conditions that justified the earlier one have passed away forever.

Naturally the older policy intended the public good. It did not consciously sacrifice the public to the private interest. Mainly, it sought to stimulate production, to establish family owned and operated farms, and to promote conservation through individual trusteeship. It fostered production but failed to achieve the other ends. It allowed immense areas to come into the possession of speculators, drove a wedge between ownership and operation, failed to maintain farm incomes, and stimulated recklessly destructive lumbering, grazing, and farming. Briefly, the system defeated the intention. It did not promote a balanced agriculture or produce farm security. The newer policy seeks these ends by other means—notably by bringing Federal, State, and local agencies into cooperation with farmers and other land occupiers in rural land use adjustment. Land acquisition by public agencies is part of the procedure. Reform of the land-tenure system, with better tenancy conditions and an abso-

lute increase in farm ownership by farm families, is another part. Cooperation between public agencies and private land users in erosion control, soil improvement, flood control, range improvement, and forestry is yet another vital feature.

Origins of New Land Policy

What are the origins of the new land policy? Land economists recognized half a century ago that the traditional policy was defective. Population pressure was carrying settlement into unfavorable lands; tenancy was increasing; farmers, ranchers, and lumbermen were wasting soil, grass, and timber; and the land use system was misdirecting settlement and undermining the social interest in the use of land. Hardly anyone acknowledged at that time, however, that the remedy lay in governmental or public action. Land tenure in fee simple, though clearly open to abuse, was the central principle of our agricultural edifice, and it was almost sacred. Other countries had modified the principle. They had provided leasehold reforms, tenant compensation for unexhausted improvements, and funds for tenant-purchase operations. But such things ran against the American philosophy, which made the rights of ownership supreme and almost absolute. Few were bold enough to propose them.

Nevertheless, the early years of the twentieth century brought a significant challenge to the laissez faire tradition. This was the movement for forest conservation, which culminated in the transfer of the national forests to the Department of Agriculture in 1905. As a result, the Department found itself responsible on a large scale for land use policy and administration. It became, indeed, the chief focus of the conservation movement. Reservation of land for national forests was the first important deviation from the long-established policy of pushing Federal land into private ownership. Six years later came the Weeks Act, which authorized the purchase of timberland for the protection of the headwaters of navigable streams. This measure went beyond the forest-reservation principle in that it brought privately owned land into public ownership for the purposes of conservation. Soon afterward the Federal Government began the purchase of land for wildlife refuges.

There was still no positive policy of land utilization for agricultural land. Land settlement and use continued to obey chiefly the incentive of private gain; but the resulting abuses attracted increasing attention. Between 1910 and 1915 land economists began to study land settlement closely and broached the idea of having public agencies help to direct it. Abuses of land settlement by private enterprise had been frequent and disastrous, and had brought the laissez faire tradition in this matter into serious disrepute. Members of this Department assembled the facts and presented them in 1915 and 1916, along with definite suggestions for the protection of settlers at least through public information and guidance.

Change in Population Growth

Up to the time of the World War the national land policy reflected a belief that our population growth would continue to be rapid. Statisticians thought the rate of increase would be nearly as great as it had been in the nineteenth century. Since all the readily available land of good quality had been taken up, it appeared as if there would soon be a land shortage, with more and more farming of submarginal areas. Our exports of grain and livestock were declining; our domestic consumption was increasing. These facts looked like pressure on the food supply and prompted effort to make additional land available through reclamation. Emphasis in agricultural thought was then still overwhelmingly on production. Conservational farming was a secondary consideration. These conditions promoted intensive soil-depleting methods of cultivation, steady encroachment of farming into grasslands, and cultivation of steep, eroding slopes. Competition for the land supply increased land prices and made the climb to farm ownership more difficult.

Post-war developments changed the situation greatly. In the first place, the rate of population growth declined. In the second place the foreign demand for our agricultural products dropped below the pre-war level. These two changes, had they stood by themselves, would have decreased the intensity of cultivation and decreased the competition for land. They would have favored a more conservational agriculture. Other post-war changes, however, had a contrary influence. There was depression and unemployment in the cities, with the result that too many rural flolk had to stay on the land. Indeed the farms had to absorb much urban unemployment as well. Consequently the competition for land was as great as ever. Its source now, however, was sheer human need rather than commercial opportunity. Commercially, agriculture required less and not more production. Pressure of population on the land supply was no longer the result of population growth and an expanding agricultural market. Instead, it was largely a byproduct of urban depression. As such, nevertheless, it complicated the land use problem tremendously.

Movement Between Town and Country

For nearly a century after the Declaration of Independence, free land gave rural youth an opportunity to become landowning farmers and also attracted large numbers from the cities and from Europe. After the Civil War, however, rapid industrial development drew farm youth to the cities. The proportion of the gainfully employed population engaged in agriculture declined from 54 percent in 1870 to 21 percent in 1930. This was the result mainly of two factors: (1) Technical progress in agriculture, which in the period mentioned increased production per agricultural worker about two and one-half times; and (2) increasing pressure of population on land resources. As a result of this increasing pressure, the balance of advantage shifted, so to speak, from homesteading to city employment. But with the onset of the depression in 1930 the movement from the farms

to the cities diminished. It was even reversed in 1931 and 1932; fully 2 million young people who under pre-depression conditions would have moved to town are still on the farms. Assuming that 10,000,000 in the Nation are unemployed, it appears that nearly 28 percent of the gainfully employed are now engaged in agriculture. From the standpoint of economy in the use of labor agriculture is overmanned. Yet through unemployment the pressure of population on the available land resources since 1930 is increasing. What is the remedy? To crowd rural folk into the urban bread lines? Or to create more nonagricultural opportunities?

These problems did not show up immediately after the war. Fears of land scarcity prevailed in 1919 and 1920 and caused a rush for land at excessive valuations. Farm expansion continued. Nevertheless new problems emerged. The Department established a Division of Land Economics in the Office of Farm Management, which was later combined with the Bureau of Markets to form the Bureau of Agricultural Economics. This unit studied the composition of farm-land values; the land boom in Iowa, Kentucky, and other States; farm-credit requirements as a means of facilitating the purchase of land by tenants; landlord tenant relationships; and the relationship between the physical and economic factors in the use of land. It demonstrated that previous increases in farm earnings do not necessarily indicate future increases and warned farmers against land speculation. Advice to the farmers emphasized conservatism in land investment and conservation in land use. It did not extend as yet to the idea of cooperative land use adjustment.

In 1922, however, the Department published a report that gave a new direction to our land philosophy and threw light on the supply of land to prospective requirements. It called attention to the downward trend in population growth; from 1910 to 1920 the rate of increase had fallen from 21 to 14.9 percent. The report emphasized the abundance of land for prospective arable requirements but urged the importance of wise, varied, and discriminating land use. It drew attention also to the need for economic and social adjustments and called for a land inventory and land classification. Commercial farming had evidently been overdone; yet land hunger was as keen as ever. This and other conflicting influences demanded study.

Related research included studies of irrigation economics; of checkerboard land tenures and the effects thereof in the range country; of misdirected land settlement; of the relationship between farm earning power, current and prospective, and farm-land values; and of land use maladjustments produced by excessive agricultural expansion. The Department made the first national land use map, developed procedures for classifying land according to its productive capacity, and indicated the need for administrative unification of the national land policy. Our land philosophy moved away from the idea that the controlling factor is simply the pressure of population on resources.

Government's Role in Land Utilization

Another landmark in the evolution of our national land policy was a land-utilization conference held in Chicago in November 1931. By that time the agricultural-surplus problem demanded attention. One proposal for dealing with it was the elimination of marginal lands. Our commercial farm plant was obviously too large. Efforts to reduce the size of it by withdrawing the poorer farms from cultivation seemed reasonable and practicable. Members of this Department pointed out, however, that the mere retirement of submarginal land would not control the surplus problem. Such land did not produce heavily; yet after a fashion it fed the occupants. It was necessary to have a much more comprehensive analysis of the land situation. The conference appointed two national committees which subsequently promulgated doctrines now generally accepted, namely, that land is vested with a social or public interest, that under individualism grave social and economic maladjustments in the use of land had developed, that each parcel of land has a socially best use, and that Government action is essential in effective land use adjustment.

By this time it had come to be generally recognized that a rational land policy would have to be many-sided. Studies of submarginal land had shown the necessity of land classification and of land zoning. Studies of dispersed tenure in the range areas had shown the difficulty of reconciling National, State, local, and private interests in range use and conservation. Overgrazing, on the one hand, and the plowing up of much range land, on the other, had created a problem that required various types of action in combination, particularly action to resolve conflicts between public and private interests and to check overgrazing, restore range vegetation, and prevent further unwise extensions of crop growing in range areas. Recurrent droughts, with resultant soil blowing and duststorms, had focused attention dramatically on the need for general adjustment. Forest devastation, soil erosion by water in the humid areas, the encroachment of agriculture into lands unsuited to it, the growing seriousness of the tenancy problem and of rural poverty in many areas, and above all, the disparity between prices of farm commodities and the commodities farmers buy, were evils to which finally the country had wakened. It demanded action, and Congress provided the means.

Recent Land Use Activities

Legislation after 1933 made possible the conservation program of the A. A. A.; research and demonstration work in erosion control; farm-tenant-purchase and rural-rehabilitation programs under the Bankhead-Jones Farm Tenant Act; the purchase and development of submarginal lands; programs of land treatment for flood control under the Flood Control Acts of 1936, 1937, and 1938; farm forestry under the Norris-Doxey Act of 1937; water-facilities program under the Pope-Jones Act of 1937; and increased forestry operations. Undoubtedly these new policies will be continued and expanded for generations, because the conditions and problems that caused them to be started will continue and will require continuous action.

Federal and State specialists are working with committees of farmers to carry out the policies in a Nation-wide cooperative program specially developed for that purpose. The task, though still in an early stage, has gone far enough to develop important principles and procedures.

Legislation by the States has moved in the same direction. Several States have passed rural zoning laws with the general object of directing the flow of agricultural settlement, and of preventing settlement where it may involve excessive costs or be undesirable for other reasons. Rural zoning through local democratic processes is increasing. Several States are revising their land-taxation procedures. They are basing assessments to some extent on the productive value of the land and in that way encouraging owners to put their land to better uses. One State has adopted legislation to define tenant rights and improve the lease-contract system. Some Western States have passed laws to encourage the development of cooperative grazing associations.

The States have wide jurisdiction in land policy, notably in matters of property law, tenure relationships, taxation, and land use regulation. Thirty-six States have passed soil-conservation laws that provide for the creation of State soil-conservation districts and for land use regulation by referendum vote. Some States are revising their basic laws with regard to the use of water, so as to promote the right use of land. Along with the Federal programs these State laws help farmers to deal with different aspects of the land use problem. It would be impossible for the Federal Government alone to do all that is necessary. The total effort involves the combined work of Federal, State, and local agencies, and of farmer groups. Each part of the program, Federal, State, or local, must be coordinated with the other parts, in processes that begin with fact finding and over-all planning.

Community and County Planning

Accordingly, the Department and the land-grant colleges, through the extension services, have helped to set up community and county agricultural land use planning committees in each county. Federal and State officials cooperate with the farmers in each step from fact finding to action. The agricultural-conservation programs in the A. A. A., with their provisions for acreage adjustment and benefit payments, are a vital factor in the undertaking, since they help the farmers to meet the costs of improving the uses of their land. These A. A. A. programs interpenetrate with all the other adjustment programs in a complex pattern of physical, economic, and social procedures. The approach from now on will be through inclusive planning coordinated at the State level, the regional level, and the national level, followed by governmental action upon recommendation of local groups of land users, within the limits of the acts of the Congress and State legislatures.

Besides the national programs for soil conservation under the A. A. A., the Department sets up erosion-control demonstrations through the Soil Conservation Service. More than 500 of these

demonstration areas now furnish practical guidance in erosion-control measures in 45 States. Farmers from the surrounding countryside visit and inspect the demonstration areas and apply indicated practices on their own lands. Soil-conservation districts offer a means of community action to help spread the soil techniques. The Soil Conservation Service cooperates with supervisors of the districts in soil-conservation work, under agreements through which the Government provides technical assistance and certain labor and materials, while the farmers agree to follow stipulated practices and provide as much of the necessary materials as they can. Payments to farmers who cooperate in the A. A. A. programs enable many to adopt conservation farming methods who otherwise could not do so.

Unwise use of land is both a cause and an effect of rural poverty. It may increase income temporarily through soil mining, but in the long run it reduces farm income and depletes the soil; the resulting low standard of rural living causes the trouble to persist. More than 5,000,000 farm people were on relief during the depths of the depression, for insecure tenure, prolonged farm depression, sudden calamity such as floods and drought, and bad farming practices had rendered them helpless. Relief involved subsistence grants and rehabilitation loans, farm and home guidance, and cooperation in erosion control and crop adjustment. The farm-tenancy problem was a cause of much maladjustment. Tenants, having no long-time interest in the land, did not always find it worth their while to farm well, and both land and men decayed. Government loans assisted a limited number of tenants, croppers, and farm laborers to purchase their land. Congress later provided additional money for this purpose.

Land Treatment In Flood Control

The Department of Agriculture first entered the field of land treatment for flood control when Congress assigned to it the job of managing and conserving forest resources. Later it assumed additional responsibility under the Weeks Forest Purchase Act, which authorized action to aid in regulating the flow of navigable streams. The Clarke-McNary Act of 1924 directed the Department to purchase forest, cut-over, or denuded lands within the watersheds of navigable streams. Two acts in 1928 provided for investigations to determine methods of preventing erosion and controlling the waterflow, and an act in 1929 established field research stations to study these problems. Relief legislation in 1936 authorized expanded work to prevent forest fires, soil erosion, and floods. The Civilian Conservation Corps camps started conservation jobs on farms, forests, and range lands. In 1935 in an act that established the Soil Conservation Service Congress declared it to be the public policy to provide permanently for the control and prevention of stream erosion as a means of preserving natural resources and curbing floods.

In 1936 came the Omnibus Flood Control Act, which gave legislative recognition to the need for an expanded program of flood control, on the upstream watersheds under the direction of the Department of Agriculture, and on main channels under the direction of the Corps

of Engineers of the War Department. Other programs of the Department promote flood control through land treatment: Notably, the A. A. A. programs, the submarginal-land purchase and development programs, the rural-rehabilitation programs, the farm-forestry program, and the water-facilities program for arid and semiaid areas. These activities help farmers to shift from a wasteful to a conservational use of land, to put their farms to better or more profitable uses, to develop and improve farm wood lots, and to conserve water in the soil.

Upstream treatment will probably be chiefly valuable in controlling minor floods; its value in major flood control should not be overestimated. Watershed treatment for flood control includes retardation of headwater flows by use of minor dams, barriers, debris basins, and bank protection; run-off retardation and soil-erosion prevention by use of check dams, terraces, contour plowing and cultivation, strip cropping, and other kinds of soil-surface engineering; forest plantations; forest-fire protection by roads, breaks, and other improvements; improvement in management of pasture and range land, wood lots, and forests, in cooperation with the owners of the land; and in some instances, in especially critical areas, public acquisition and development of lands. Erosion control on the watersheds is the only effective method of reducing the shoaling of stream channels and silting of reservoirs.

Success in the flood-control program requires cooperation by the Department and the people who live in the flood-source areas. Most of the land involved is privately owned and must give the occupants a livelihood. Hence, the flood-control operations must not only be sound from a physical point of view but must harmonize with the social and economic interests of the individuals and communities affected. As a means of promoting the necessary cooperation, the Department invites the cooperation of local people in the planning stage and in the operation stage and works also with locally organized soil-conservation districts. In a few of the more critical watersheds actual physical work is already under way.

Submarginal-Land Retirement

Key instrument in the purchase and development of submarginal land is the Bankhead-Jones Act, which authorizes the Government to purchase lands unsuited to cultivation. This operation, often without costing very much money, may change the land use pattern favorably throughout large areas. Usually it suffices to divert the poorest farms to nonfarm uses, such as forestry, grazing, or recreation. With that accomplished, the task of reorganizing agriculture throughout the rest of the area is much less difficult. Occasionally whole areas should be retired from agriculture; they can never furnish an agricultural livelihood.

Under the Bankhead-Jones Act the Government can promote these objects together. Sometimes the problem involves the relocation of some farm families. Shifts of land from crops to grass or forestry or to other less intensive uses may necessitate a reduction in the

resident population. In parts of the Great Plains hundreds of farms are ill-adapted to crops and yet too small for economical operation as stock ranches. Land purchases by the Government may be the only means of suitably rearranging the tenure pattern, and of establishing operating units of the right size. In central Montana, for example, the purchase of 260,000 acres of land unsuited to farming was the first step in a successful range-improvement project. The land purchased consisted mainly of three types: (1) Small dry-land farms whose owners wished to move, (2) abandoned homesteads, and (3) selected tracts strategically located for the development of water facilities. Subsequently the Government leased the entire purchased acreage to local grazing associations.

The Water Facilities Act

As a means of conserving and more efficiently utilizing the available water supply in areas where rainfall is scanty and irregular, the Pope-Jones Water Facilities Act is effective. It authorizes a program in arid and semiarid areas in the Western States—Washington, Oregon, Idaho, California, Nevada, Utah, Arizona, Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, New Mexico, Kansas, Oklahoma, and Texas. The funds are limited, and the work is concentrated in areas of human distress where good opportunities exist for water development. Often the development of a small facility is all that the farmer or rancher needs to make a success of his business. On range lands, for example, springs may be developed, wells may be dug where ground water is available at reasonable depths, and small impounding dams may be constructed to create water supplies for livestock. Storm water and spring runoff from snow melt may be diverted from watercourses and spread on hay lands. Farmers and ranchers who benefit contribute to the cost in proportion to their ability.

Farm Forestry

Along with its work on the public forests the Department promotes farm-forestry programs. Nearly one-third of all our forest land is on farms. Most farm wood lots, because of their location and comparative nearness to markets and the facilities available for managing them intensively, are capable of producing greater returns than forest lands in other types of ownership. Actually, farm wood lots are generally overcut, overgrazed, and seriously depleted. They produce only about one-third of their capacity. Nevertheless, in 1934 such farm forest lands contributed $62,000,000 in cash to more than 2,500,000 farm families and in addition about $54,000,000 worth of such farm-used products as fuel and fence posts. In 1937 Congress passed the Cooperative Farm Forestry Act, which authorizes Federal cooperation with farmers in establishing farm shelterbelts and managing farm woodlands.

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Broad Scope of Land Use Planning

This outline gives only a faint idea of the complexities involved in land use adjustment. There are more than 500 different type-of-farming areas in the United States, each with special problems as well as with problems common to them all. Even in the main areas such as the Corn, Wheat, and Cotton Belts and the dairy and livestock regions, farm conditions and methods are diverse. Within the Cotton Belt, for example, 15 or 20 subregions can be delineated. Yet the total land use program is not a mere bundle of local programs but an organic unity. The parts mesh in necessary interdependence and promote national objectives. Complexity in the problem has its inevitable counterpart in complexity in the coordinated program.

Many things besides those already mentioned affect the issue. Rural land use planning must consider problems of comparative advantage, of interregional competition, of price and income trends, of farm technology, and of urban buying power. For the present agriculture must take care of many people on the land for whom no remunerative work can be found there. Inevitably, it serves as an economic shock absorber. This factor is all pervasive in the problem. Nothing less is involved in rural land use planning than the total welfare of this Nation. In land use programs for the individual farm, for the local community, for the State, for the region, and for the country as a whole the final goal is the general welfare. Farm people are striving to reach a stable, permanent agriculture with adequate incomes for farm families and at the same time provide for a continuous and abundant supply of farm products, maintain the soil and its fertility, stabilize tenure, and eliminate rural poverty. To reach their goal they make use of both State and Federal authorizations.

HUMAN SIDE OF LAND USE CHANGES

Problems in the adjustment of population to resources are not the result of any real pressure of numbers on the supply of land. As compared with many countries in Europe and in the Orient, the United States has a low ratio of population to natural resources. There is no need whatever to fear an actual land shortage. Growth of population is slowing down, and within 40 or 50 years the total population may be declining. With a rational allocation of land resources among the major uses, enough will be available to provide for our maximum probable population and to allow also for ample forests, wildlife refuges, and parks. Our problems in the adjustment of population to resources are economic and social, rather than biological.

Mainly they concern (1) urban employment, (2) domestic consumption, (3) foreign trade, (4) the ebb and flow of population between town and country, (5) the land-tenure system, and (6) the coexistence of commercial with so-called noncommercial farming. Efficient handling of them would give us more production, higher standards of living, and reduced competition for farms. It would

make the overmanning of agriculture unnecessary, through the provision of other ways of enabling people to earn a livelihood. Meantime, nevertheless, population-adjustment difficulties accumulate and must be tackled.

Migration from farms to cities formerly lessened the pressure of population on the land supply, but much population now remains on farms, and unemployed urban people seek refuge there also. Advancing farm technology reduces the labor requirement in commercial agriculture; declining agricultural markets have the same effect. Nearly one-third of our farm population is in areas where, for the sake of conservation, the land use system should be changed, and where less intensive should partially supplant the more intensive agricultural uses. Actually to bring about that change would require more and not less migration from rural to urban areas. Migration would need to be larger than the natural increase in the rural population; it would need to have rational objectives and to promote ultimate stability in the population pattern. In the absence of an increase in nonfarm employment, such migration is difficult if not impossible. What we have instead is the misdirected or aimless kind.

In the early 1920's the number of births in the United States reached a high level. As a result, the number of persons now reaching working age is relatively large. Even though industrial employment has recovered to about the same level as in 1929, it does not absorb the increase in the working force. Unemployment has increased by about the number of new workers added since 1929. Employment will have to be much larger than it was then in order to carry an equal labor force and the increase besides.

Farm youth particularly find the situation difficult; for population growth is greatest in the rural areas. Agriculture cannot absorb all of its own increase in personnel, but relies on the cities to absorb part of it. Present agricultural conditions, with prices low and surpluses large, make commercial agriculture less able than usual to employ its maturing youth, and the young people have less than the usual chance to secure other employment. Hence urban employment is basic in the rural population problem.

Migration Intensive Up to 1920

Up to 1920 the migration from farms was intensive. In parts of the Cotton Belt, in much of the southern Appalachian and Ozark Mountains, in the Lake States cut-over sections, and in scattered areas throughout the country the net movement toward urban centers between 1920 and 1930 was 20 percent or more of the total at the beginning of the period. By 1930, for the country as a whole, nearly two out of every five of the young people who had reached the age of 20 during the preceding decade had moved to urban centers. They had gone there to seek better opportunities and generally had found them—at least from the standpoint of earnings.

The 1920's were a period of farm depression and of relative urban prosperity, with industry fairly active though not employing the total available labor force. About three-fourths of the rural mi-

grants went to the 167 counties in which manufacturing predominates. The metropolitan areas of New York, Chicago, and Detroit absorbed about one-fourth of the migrants. Los Angeles and its surrounding area absorbed nearly one-sixth. Two-fifths of the new workers in cities hailed from farms.

Late in the 1920's the migration to cities began to decline: after 1930 it dropped sharply, and some channels of rural-urban migration ceased to function. In some industrial cities, including Detroit, the population decreased. Between 1930 and 1939 the movement from farms to cities was only about two-fifths of the corresponding movement between 1920 and 1929. Meantime, many urban workers moved to the land. From 1930 to 1939 the number of people on farms increased by about 200,000 each year; the increase was nearly sufficient to offset the average decrease of about 100,000 annually between 1910 and 1930.

Nearly half of the annual increase in the working-age population is on farms. Commercial agriculture needs only a fraction of these new workers. With modern technology it can produce the Nation's foods and fibers, and a large additional volume for export, with far less than the number of people now on farms. Mechanization increases the average size of family farms, and decreases the amount of seasonal labor required; it brings about either a smaller total number of workers in a given area or a reduction in the total amount of employment available to the same number of workers. In the production of some crops the output per man-hour has increased only moderately. For some of these crops there is an increasing demand. On the whole, however, agriculture can employ at present only a small part of the annual increase in its working-age population.

Trend Toward Noncommercial Farming

Further technological improvement in agriculture, if unaccompanied by market expansion, will mean further lessening of the demand for farm labor per unit of output. Additional workers can be absorbed only through a reduction in the level of rural living. One result is an increase in so-called noncommercial agriculture. Surveys indicate that the number of workers increases proportionately less in the commercial than in the noncommercial and generally poorer farm areas. Migration from the major commercial farming areas is still quite heavy; in some of them the farm population continues to decrease. Areas of less commercial agriculture, of poorer land resources, and of lower agricultural incomes, on the other hand, show different population trends. Migration from these areas is less, although they have the highest proportion of maturing farm youth.

In many areas rural youth, for lack of other outlets, turn to production for the farm table; in other words, to subsistence agriculture. Urban folk who seek a rural refuge do likewise. So-called subsistence farming is usually their only recourse. Some of them go to regions where the existing rural population combines farm with nonfarm work. This practice, which they emulate, sometimes works

quite well. Large numbers of farm families, however, have no part-time nonfarm work and rely on essentially subsistence types of farming. They contribute little to the market supply of agricultural products, and gain only a meager living. Even in 1929, which was a good year for agriculture, the less productive half of the farms produced only 11 percent of the crops marketed. Probably noncommercial farming will increase, particularly where land values are low and where farming of this type requires almost no capital.

Many of the people who take it up, however, are ill-adapted to it or indeed to other occupations. Training and education have not equipped them to compete successfully in better land areas, or in urban employment. Their whole background has not fully fitted them for a desperate struggle with reluctant nature. Lacking the knowledge and skill required, they do poorly. It takes a rather unusual combination of intelligence, skill, and physical vigor to wrest a livelihood from a small poor farm. Without these advantages and without livestock or adequate tools, the returns are pitifully low; the comparative costs extremely high. Some few win out to moderate efficiency. Large numbers fail and have to apply for relief. In areas where, from the standpoint of conservation, much of the land should be withdrawn from agriculture, the proportion of the population on relief rolls in the year ended June 30, 1935, exceeded the national average of 15 percent in three-fifths of the counties.

Solution Not Exclusively Rural

Movements of population, the retention of surplus population on the farms, the search of the urban unemployed for a rural refuge, the changing status of the rural landless under the double impact of farm machinery and of restricted agricultural markets, and the relocation problems associated with the Nation-wide programs for crop adjustment and better land use, are different aspects of a single problem. It is inevitably in large measure a governmental problem with urban as well as rural implications. Solution of it on a rural basis alone is impossible.

Ultimately, the remedy must be sought in urban and rural readjustment together. Even normal industrial recovery would not suffice to absorb the redundant farm population as well as the existing mass of urban unemployed. Manifestly the problem must be attacked through public agencies in all its aspects simultaneously. On the industrial side, governmental policies must continue to stimulate activity, and in the rural sphere governmental policies must endeavor to harmonize commercial farming, relatively noncommercial ways of rural life, and better land utilization. Land use adjustment must include population adjustment, or it will be defeated.

Research and experiment by Federal and State agencies have shown that the condition of the disadvantaged groups in agriculture can be greatly improved through public action. Constructive programs are under way. They include such things as guidance in land settlement; efforts to provide part-time nonfarm work; farm and home guidance; rural rehabilitation loans; measures to improve tenure

conditions; measures to put worthy tenants in the path toward farm ownership; encouragement to cooperative activities for the production and rural interchange of goods and services without the use of money; programs of public employment in forest, range, and recreational areas; and the development of educational and other social services.

Cross Currents in Migration

Population trends that complicate the land use programs have many cross currents. For example, the back-to-the-land movement between 1930 and 1935 was so large that had it been the only factor involved, the increase in the total farm population would have been 6.6 percent. Actually, the increase was only 4.5 percent. Migration from farms counteracted the back-to-the-land movement, and part of the natural rural increase as well. It was so large that if there had been no back-to-the-land movement, the farm population would have decreased by 2 percent between 1930 and 1935. All told, about 1,000,000 persons arrive on farms from towns and cities each year, with the largest proportional movement into areas near large cities and the smallest into relatively stabilized agricultural areas.

In the constant ebb and flow, some farming areas lose population and others gain. The migration is not always in response to real differences in economic opportunity. If that were the case, it would bring about necessary readjustments automatically, and would cause abandonment of land that should be retired from cultivation. Actually migrants leave stable and unstable areas alike. Few intelligent efforts have been made to guide them from areas of lesser to areas of greater opportunity, or to induce a greater migration from the poorer than from the better land. For example, between 1930 and 1935 the farm population increased about 9 percent in the areas where good land use adjustment required decreased population. On the other hand, between 1920 and 1930 migration out of relatively stabilized agricultural areas was almost as great as out of the least stabilized areas.

Research in Population Adjustment

Guided and even stimulated migration should accompany the land use-adjustment programs. It should bring higher standards of living for both migrants and nonmigrants; otherwise the attempt at land use adjustments will involve social maladjustments and will entirely fail to reach the true objective. Knowledge of population facts and trends is essential. Major land use readjustment is most urgent where migration trends and the natural increase of population make it most difficult. Full particulars of the local situation will be necessary to resolve this conflict.

Part of the solution must be a direct attack on the human elements involved. It must include programs for rural education and the more efficient use of resources, programs for guidance in relocation, and possibly financial aid to willing migrants. Guidance in relocation implies that equally good or better opportunities are available elsewhere, either in agriculture or in nonfarm occupations. The devel-

opment of nonfarm opportunities for both the urban and the rural unemployed is an essential element in a solution of rural population problems, and efforts should be made as well to develop higher levels of living for the numerous farm families whose crops play only a small part in the total marketed products, but who are wholly or partly dependent upon agriculture for their livelihood.

AIDS TO RURAL UNDERPRIVILEGED

On June 30, 1939, the Farm Security Administration program for helping low-income farm families to become self-supporting concluded its fourth year of operations.

From an administrative viewpoint, the year has been marked chiefly by reorientations and alignments that have knit the farm security and allied programs more firmly into a fabric of coherent departmental effort. The year has also witnessed an extension of administrative initiative beyond the primary program of farm-equipment loans and operating loans, toward auxiliary services designed to protect the families' drive toward self-support and self-reliance. These services include a health program, a community-service program, and tentative steps toward cushioning the impact of technological, labor-saving developments upon the farm population. This shift in emphasis does not mean a slackening of effort in the basic program of individual rehabilitation loans; rather it indicates that the loan program is working more smoothly as the result of several years of experience, and that there now is more opportunity for work on the families' secondary lines of defense.

Scope of Operations

More than 600,000 needy farm families have received aid in planning and financing their farm enterprises. County supervisors have reported that they know of an additional 350,000 families in need of aid who cannot be reached with present funds. The scope of the aid extended to borrower families includes the total family enterprise.

This requires an adaptation of farm operations not only to individual difficulties, but to regional and national problems. On the High Plains, for example, it has been necessary to aid all borrowers in certain areas to change from specialized crop farming to diversified crop and livestock farming, better suited to an area of recurrent drought. In the South, diversification has been encouraged in order to protect threatened soils and to forestall disasters in a glutted cotton market. Throughout the Nation it has been necessary to encourage all borrower families to produce food and feed at home, as a measure of security against uncertain crop and commodity prices. The Farm Security Administration has sponsored tenure improvement, health care, rural-sanitation measures, community cooperation, soil conservation, crop-seed and livestock improvement, guidance of farm-labor migration, and adoption of modern farm implements.

Rehabilitation

The rehabilitation program is the most extensive Farm Security Administration program. It developed out of the first efforts of the Federal Government, through State emergency relief administrations, to aid approximately 1 million farm families which were on relief rolls in 1933. It is a joint educational and financing activity, based on standard rehabilitation loans combined with supervised farm- and home-management plans. The loan program is reinforced where necessary by provisions for cooperative medical care, the voluntary adjustment of farm indebtedness, the establishment and maintenance of community and cooperative services and water facilities, and the encouragement of improved tenure and leasing arrangements which provide security of occupancy to tenant borrowers.

Planning and Guidance in Farm and Home Management

The central element of the rehabilitation program is the policy of loaning money only on the basis of individual farm- and home-management plans. When a family applies for aid, the county rehabilitation supervisor and the home-management supervisor cooperate with the farmer and his wife in analyzing their resources. On the basis of this inventory, an effort is made to ascertain what the family needs to make it self-supporting and self-reliant—whether that be more or better land, improved farm organization and practices, more livestock or equipment, or more self-sufficiency in farm and home operations to reduce the need for cash for consumption purposes. Then the family, with the assistance of the supervisors, works out a plan for meeting these needs. A typical farm- and home-management plan calls, first of all, for the raising of enough vegetables and livestock to meet the family's own subsistence needs. A canning budget is devised to provide a balanced, adequate diet through the winter months. Acreage is set aside for the production of feed for the work animals and other livestock. The remainder of the farm enterprise is devoted to diversified production of livestock, livestock products, and cash crops.

Standard Rehabilitation Loans

Insofar as the farm and home plans call for additional materials, goods, and equipment, the Farm Security Administration approves loans to farmers who cannot obtain adequate credit elsewhere. These loans are made for periods of from 1 to 10 years, depending upon the purpose for which the money is used and the life of the security. Interest is charged at the rate of 5 percent and accrues on the principal only. The size of the loan naturally varies with the type of agriculture in each area. The average loan, original and supplemental, to standard clients during the past year was approximately $396.55.

Cooperative Medical Care

The health of the family necessarily has a direct and important bearing on its progress toward rehabilitation. Frequently farmers have difficulties in making ends meet because of sickness in their families. In many instances throughout the country, local medical societies have cooperated in organizing health programs, to provide medical care for low-income farm families at a cost they can afford. Whenever such programs are in operation, the Farm Security Administration is willing to loan money to its client families to obtain the medical care needed in their rehabilitation.

Adjustment of Farm Indebtedness

A special farm-debt-adjustment program provides a means of bringing distressed farm debtors and their creditors together, to discuss their mutual problems, and to arrive at adjustments which will prevent foreclosures. This service is available to all farmers whether or not they take part in other phases of the Farm Security Administration's program.

The success of the program has been due in a large measure to the influence, advice, and assistance of voluntary State and county farm-debt-adjustment committees. There are at present 40 State committees composed of 355 members, and 2,907 county committees (out of 3,073 counties in the United States) having 11,387 members, all serving without salary.

In addition to the adjustments made in individual cases, many irrigation, levee, and drainage districts, cooperative-organization, and other groups have found a solution of their debt difficulties through farm-debt adjustment.

During the period from September 1, 1935, to June 30, 1939, adjustments were arranged for 101,296 individual farmers. The total of the debts of these individuals originally amounted to $328,829,495, which have been reduced to $249,608,247, a reduction of $79,221,248.

The Water-Facilities Program

Under specific authorization by Congress and in cooperation with the Water Facilities Board, the Bureau of Agricultural Economics, and the Soil Conservation Service the Farm Security Administration has aided in the development of a small water-facilities program for the benefit of low-income farm families in the arid and semiarid areas of the 17 Western States.

During the past year 330 water-facilities loans were made to individual farmers involving a total of approximately $184,315. About $9,000 was granted to 41 farmers for the same purpose. In all 371 farm families were assisted in their attempts to attain a self-supporting and self-reliant status through a wiser use of available water resources.

Provisions for Secure Tenure

Secure and equitable tenure arrangements are essential to safeguard the Government's investment in both the standard rehabilitation and the loans for cooperative services and water facilities. The Department generally requires that the tenant borrower have a written lease which assures him reasonable security of occupancy.

Since existing leasing customs are deep-rooted, the Farm Security Administration is not attempting an abrupt departure from prevailing practices, but is working gradually toward improvements which will make it possible for farm tenants to find a permanent basis of livelihood. Lease forms have been prepared to fit the laws and customs of every State.

The Grant Program

There is a group of destitute farmers to whom rehabilitation loans could not be given wisely even if money were available. Thousands of families living in drought areas have not received loans, because their land did not contain enough subsoil moisture to justify planting a crop. A large number of families have migrated from the Dust Bowl regions to the Northwest and Pacific Coast States. Many of these are earning a scanty hand-to-mouth living as farm laborers, while others have settled on acreages too small or too barren to provide a permanent support. It would be a waste of the Government's money and an injustice to the borrower to attempt rehabilitation on such submarginal land. In such circumstances, therefore, the Farm Security Administration has temporarily made subsistence grants rather than rehabilitation loans. During the past year the total grant disbursement amounted to about $20,907,655.86.

Progress of Rehabilitation Clients

A survey of the progress of standard rehabilitation borrowers at the end of the 1938 crop year indicated that throughout the country, except in areas suffering from drought and other natural catastrophes, standard rehabilitation clients have increased their home food production, farm diversification, working equipment, living standards, and total net worth. A total of 232,947 client families were surveyed. They owned only 276,620 work animals at the time of acceptance on the farm security program. By the end of the 1938 crop year they owned 510,190 work animals. The average number of subsistence cattle owned before the first-year clients began to participate in the program was 2.2. At the end of 1938 the same clients owned an average of 3.9.

The rise in the standard of living has been attended by an increase in the net worth of the borrowers. The decrease in cash outlay for subsistence has resulted in larger expenditures for other and more lasting betterments. The net worth of these standard rural-rehabilitation families—that is, the value of furniture, clothing, supplies, livestock, and equipment, minus debts—has increased $269.47 per family since they received loans from the Farm Security Ad-

ministration. This means an addition of more than $62,773,173 to the wealth of the communities by this group of 232,947 families alone.

The results of the rehabilitation program cannot be measured in dollars alone. Before receiving the rehabilitation loans, only 37 percent of the first-year clients had written leases. At the end of 1938, 85 percent, or 39,316 clients, had them. Thus 48 percent of the first-year clients changed from verbal to written leases. Moreover, during the same period 19 percent of these clients obtained longer-term leases than before. In 1937, 3,407 of the first-year clients had advanced from sharecroppers to tenants; 18,161 did so in 1938. This number added to the second- and third-year clients in the same category totaled 26,800 clients who advanced from sharecroppers to tenants between December 31, 1937, and the same date in 1938.

Homestead Projects

It has been the function of the homestead projects to demonstrate sound principles of farm and community management, and to experiment with modern developments in those lines.

While the rehabilitation program is designed to help a large part of the low-income farm population with proven devices, the homestead program reaches only to sample groups, and therefore a greater latitude for experiment has been possible. Homestead projects are scattered throughout the country in nearly all States, crop areas, and climates. Some projects have been occupied by families selected from among stranded population groups; some from among tenants in nearby areas; and others from among former residents of submarginal lands. Every effort has been made to provide as wide a variety of background as possible, within the limits of total accommodations—no more than 13,000 families are at present involved.

The scope of the homestead program's influence, however, reaches into demonstrations and experiments in community life, education, recreation, and economic cooperation, as well as into the individual farm practices.

Projects have been established with scattered individual farms; with one big cooperative farm operated by residents as a group; with various combinations of the two; with industrial enterprises to supplement farm incomes; with houses scattered on individual tracts; with houses clustered in a group, with superior housing and with modest housing; with specialized operating plans; and so on through a variety of choices which American agriculture must face in the calculable future.

Meanwhile, a continuing function is the management and conservation of the investment of the Federal Government in the 175 farm and housing projects, having a total value of over $100,000,000. These projects represent an approach to economic security and improved living conditions for 13,930 families on permanent farms and homesteads, and provide camp facilities for over 6,500 migrant agricultural families. On June 30, 1939, 104 projects were completed and 71 projects were under way, most of them nearing completion. When complete the projects will provide homes for 21,804 families.

Rural and Suburban Homesteads

Projects now being managed fall into two large groups—rural and suburban. The rural projects range from subsistence homesteads to full-time farms. The former class, originated by the Division of Subsistence Homesteads, Department of the Interior, are set up to provide supplementary income to persons whose main livelihood is from industry or business. These projects number 28, are inhabited by 2,308 families, and are located in 14 States. An additional 14 projects similar in plan to subsistence homesteads bring the total number up to 42.

Sixty-one of the full-time farming projects consist of individual farms, located together in a community so that necessary educational, social, and business facilities may be used in common. Sixty-nine of the rural projects are made up of scattered farms. They make use of business and social facilities of the neighborhood where they are located but usually have the advantage of cooperative enterprises.

In addition, there are 3 suburban housing projects known as Greenbelt communities. Located outside of Washington, D. C., Cincinnati, Ohio, and Milwaukee, Wis., they provide housing for 2,129 families in a rural setting, but within easy reach of large employment centers. Each family may have its own garden, if it so wishes, on land that is part of the area included in the project.

In some of the subsistence-homestead communities it has been necessary to supply industries to supplement income from the land. On eight projects, there are now industries: A wood dimension mill at Tygart Valley Homesteads, West Virginia; a clothing factory at Westmoreland Homesteads, Pennsylvania; a tractor assembly plant at Arthurdale, West Virginia; and hosiery mills at Bankhead Farms and Skyline Farms, Alabama; Cumberland Homesteads, Tennessee; Penderlea Farms, North Carolina; and Red House Farms, West Virginia.

Resettlement Services to Negroes

The scope of services to Negroes has been considerably enlarged. On June 30, 1939, there were 1,458 Negro families living on 33 resettlement projects located in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas, and Virginia. On these projects, Negro farm- and home-management supervisors and project nurses have been used as far as possible, in addition to 2 Negro community managers and a Negro cooperative manager. Marked progress has been made in raising income and improving living standards.

Tenant Purchase

The tenant-purchase program, a long-term program written into law by the Congress in 1937, deals directly with the problem of farm tenure and indirectly but importantly with the problem of farm citizenship. Its immediate goal is ownership of farms by farmers. It has indirect effects upon farm citizenship through its encouragement of stable residence, which promotes interest and participation in

community affairs; of independence of thought and action, which must be based upon a feeling of security; and of education.

As authorized by the Bankhead-Jones Farm Tenant Act, $25,000,000 was appropriated for the tenant-purchase loan program during the fiscal year 1939. Of this amount 5 percent was allocated for administrative expenses and the remaining $23,750,000 was apportioned among the States and Territories on the basis of farm population and prevalence of tenancy. (Including unencumbered balances of the previous year, the total amount allotted for loans was $24,320,000.)

These loans were made in 732 counties, of which 333 had been designated during the preceding year for tenant-purchase loans. Counties were designated by the Secretary of Agriculture on the recommendation of State farm security advisory committees. In selecting counties these committees were guided by such factors as farm population, prevalence of tenancy, and availability of satisfactory farms at reasonable prices. The counties designated are relatively more numerous in the Southern States where the tenancy problem is most acute.

The widespread demand for tenant-purchase loans is indicated by the fact that 109,912 applications were received during the year. This number, together with the 36,178 applications held over from last year, made a total of 146,090 that were on hand, amounting to an average of 34 potential borrowers for each loan made during the year. In the 14 Southern States, the number of Negro applications received during the year was 5 times that of last year. Out of 92,859 applications in these States, 25,244, or 27 percent, were from Negroes.

Variable-Payment Plan

Under the terms of the Bankhead-Jones Farm Tenant Act borrowers may elect to repay their loans under a variable-payment plan, which means that in years of above-normal income the borrower will be expected to pay more, and in years of below-normal income he will pay less than the annual installment under the fixed-repayment plan, which is amortized at 4.326 percent per annum.

This is the first instance in national farm-loan legislation where recognition is given to the variability of farm income due to factors often beyond the operator's control. The variable-payment provision in the act is based on the borrower's ability to pay and the payment due in any given year is determined by the net income for that year, as indicated by accurately kept farm accounts.

The response to the variable-payment plan has been good, and it is expected that a majority of borrowers will take advantage of the protection provided by it.

LOCAL, STATE, AND FEDERAL PLANNING FOR AGRICULTURE

Government participation in the operation of our agricultural economy dates back to the early laws for the disposal of public lands. It took new forms during the World War of 1914–18, notably with the establishment of the cooperative farm-credit facilities now oper-

ated by the Farm Credit Administration, and the adoption of measures to increase the production of grains, meats, and fibers. The post-war crisis led to the establishment in 1929 of the Federal Farm Board, and to extensive price-stabilization operations by that agency. By 1933 it had become evident that Government measures to assist farm operators in adjusting their production were necessary. The action programs of the Department of Agriculture—in rural rehabilitation, soil and forest conservation, balanced and abundant production, regional production adjustment, acquisition of land unsuited to agriculture—all have their origin in problems that cannot be solved by the old formula of education, research, and extension alone.

These action programs necessitate economic planning. There is nothing to indicate that the conditions which made it necessary for Government to act (and hence to plan) for agriculture will abate or disappear. On the contrary, new problems that call for planning are constantly developing. The new war in Europe creates new problems. It may make increased demands on our soil and forest resources, and may call for substantial changes in our existing plans. If farm production should be expanded, the expansion will need guidance as a safeguard against the repetition of previous mistakes. Should a labor shortage develop, measures may be needed to economize manpower. If the required adjustments should mean larger farm units, planning will be needed to prevent the reduction of too large a proportion of our farming population to the status of wage laborers. Planning is necessary in forming general policies and plans of action; in coordinating the action policies and programs of the various operating agencies of the Department; and also in adapting the action programs to varying local conditions.

In 1939 the Department of Agriculture developed new facilities for coordinating its several programs and fitting them to local conditions. It created a definite mechanism of planning, in which all interested groups could be fairly represented. The result was an immediate and substantial gain in program coordination. Separately planned programs had previously resulted in some duplicate coverage of certain matters and some neglect of others. Coordinated planning from the ground up, from the locality to the State and finally to the Nation, with the planning carried through to administration and action, was fully launched.

The Mount Weather Agreement

New problems arose in the relation between the Department of Agriculture and the land-grant colleges. It was necessary to agree as to what responsibilities the colleges should assume in the action programs. The Association of Land-Grant Colleges and Universities appointed a committee to confer with a committee in the Department of Agriculture, and work of the two committees culminated in a joint statement signed by representatives of the association and of the Department at Mount Weather, Va., on July 8, 1938.

Under the terms of the Mount Weather agreement, the Department is administering its "action" program and is cooperating with the

colleges in establishing a planning organization and planning procedures. Through these instrumentalities farm people collaborate with technicians and administrators in the formulation and coordination of comprehensive national agricultural land use plans. They help also in the adaptation of these plans to local conditions. Agricultural planning in each State is headed by State agricultural land use-planning committees consisting of representatives of State and departmental agencies working in the field of agriculture, and of farm men and women representing major type-of-farming areas. These farm men and women constitute a majority of the committees.

The State director of the Extension Service is chairman of the committee, and a representative of the Bureau of Agricultural Economics serves as secretary. State extension and experiment station representatives, together with a State representative of the Bureau of Agricultural Economics, constitute in each State a joint land-grant college bureau committee which, on technical matters, has an advisory relationship to the State land use-planning committee. In the counties, planning is conducted by county committees consisting predominantly of farm men and women, but on which State and departmental agencies are represented. Subcommittees organized on a community basis do much of the detailed work upon which county plans are based.

The chief function of the planning organization is to crystallize representative local thought, and convey it to the particular State or departmental agency that can act on specific proposals. A closely related function is to provide a means by which coordinated action may be taken on recommendations and proposals involving the work of several agencies. Conversely, from the agricultural colleges and cooperating State agencies, and from the Department of Agriculture, this planning organization conveys world and national facts and viewpoints and also technical knowledge downward to the local community. It provides a means for the local people to obtain essential broader information and to act upon it democratically in shaping agricultural policies.

The Fourfold Objective

The objective of the program is fourfold: (1) Democratic participation of farm men and women in the planning of action programs, (2) adaptation of national policies and programs to varying local conditions and to local problems, (3) coordination of the many bureau and division activities into one broad, comprehensive program, and (4) coordination of Federal, State, county, and local action on agricultural problems.

The first step is preparatory. It acquaints the county agents and the local committees with the scope and objectives of the planning program, prepares them for more intensive work later, and provides an organizational framework whereby various types of extension activities such as production and price-outlook meetings, marketing programs, farm-management schools and the like can be integrated with the planning program.

The second step consists of making technical information available to county and community committees. Soil surveys, erosion surveys, farm and population data, farm-management studies, technical marketing, livestock, crop, and other studies have a bearing on land use planning. With such information at hand and with appropriate technical advice and guidance, county committees make land-classification maps that show the most desirable uses to which land in the different areas in their counties should be put. Then the committees indicate the measures needed to achieve the desired adjustments.

The third step consists of making specific recommendations for action under existing programs or recommendations for new programs where existing programs do not fit the requirements. The three steps are called the preparatory, the intensive, and the unified program phases of planning. Administration officials of the active agencies participate in developing suggestions.

By July 1, 1939, preparatory work had been inaugurated in about 830 counties and intensive planning work in about 450 counties. Intensive work will be started in about as many more in 1939–40. Unified programs will be attempted in at least 1 county in each State for administration in 1940.

Action on County Plans

County-planning efforts are being translated into action. In Childress County, Tex., for example, the Prairie States forestry project planting areas are being relocated in accordance with a comprehensive plan developed there. In Beaver County, Okla., the Farm Security Administration uses the plan for that county in discouraging the continued occupancy of poor land areas, and in building individual farm-management plans as the basis for rehabilitation loans. State and county governments also use these plans. On the recommendation of the county planning committee, Young County, Tex., has purchased terracing equipment for use on farm land. Worcester and Wicomico Counties, Md., have each agreed to appropriate money for farm-drainage work along the Pocomoke River watershed, as a result of a study of local drainage needs by the planning committees in these counties. Farmer backing for a rural zoning enabling act found expression through the planning committees of two northern Minnesota counties.

There are two elements of strength in the organization which promise maximum influence on action programs: (1) The planning is done by the people who are most interested in the programs. Presumably their recommendations represent what they want and what they are willing to work for. (2) There is strength in the organizational tie-up of the planning program with the action agencies, which are represented on State and county committees. Successful operation, however, depends on the solution of operation problems. It requires truly representative committees. It requires competent leadership. It requires constant adjustment of programs to changing problems.

Representation on Committees

Foremost is the problem of obtaining truly democratic representation of agricultural interests on the planning committees. Successful agricultural planning as a democratic process requires that all agricultural interests be represented. Possibly some plan of group representation is needed, with the different groups nominating or electing persons to represent them.

Then there is a question of representation broader than just that of farmers and farmer interests. This has arisen notably in localities where part-time employment in factories may be an important element in maintaining or developing a satisfactory form of agriculture. It has arisen also in connection with planning for the use of forest lands which may not be a part of farms yet which may be essential to a successful farm economy. In such cases it becomes necessary to have the advice of industry's representatives, of the general public, and others.

The problem of leadership is a problem of obtaining and developing men with technical knowledge and vision, and with the ability to advise with and work with farmers in democratic procedures. It is a problem for this Department and for the agricultural colleges. The war in Europe gives dramatic immediacy to the problem of coming to grips promptly with new problems. This requires a combined statistical, observational, and interpretational (research) service closely linked with the planning mechanism, so that new facts, relationships, and interpretations thereof can be quickly channeled to the planning groups as a basis for timely decisions and action. To provide this service is the special task of the Bureau of Agricultural Economics.

Following are some objectives of this planning:

1. To acquire and diffuse useful information on subjects connected with agriculture in the most general and comprehensive sense.
2. To assist farmers, through research, experiment, and education, to increase the efficiency and reduce the unit costs of their production.
3. To assist farmers in improving the quality and increasing the variety of their production.
4. To achieve a balanced agriculture and at the same time to improve the general balance between industry and agriculture so that both farm and nonfarm production can be increased in a harmonious ratio.
5. To promote security for both farmer and consumer through the maintenance of an ever-normal granary by means of efficient production, adjusted production, conservation of the soil, balanced marketing, and crop insurance; in other words, to help stabilize farm supplies and prices.
6. To help maintain and increase the ownership of family sized farms by the operating occupants, and in other ways to improve the land-tenure system.
7. To promote the conservation of soil, water, and desirable vegetation.
8. To regain our agricultural export trade so far as it is practicable for us as a creditor nation to do so—ultimately through reciprocal trade agreements and international commodity conferences; meantime by methods of a more temporary nature.
9. To work for the protection of the food and drug supply from adulteration, contamination, and fraud, and the meat supply from disease.
10. To promote the intelligent consumption of agricultural products.
11. To eliminate or prevent social hazards and to correct economic abuses through the administration of various regulatory statutes.

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12. To improve marketing conditions through crop reporting, supervision of the great commodity exchanges, and commodity grading, standardization and inspection.
13. To safeguard the United States from the introduction of agricultural pests and diseases from abroad and to check the spread of such diseases and pests within the country.

FEDERAL CROP INSURANCE

"All-risk" crop insurance for wheat was introduced during the 1939 crop year. Appraisal of the plan cannot be made from the results obtained in a single crop year but must await the experience of a period of years. However, the ready acceptance of the program by wheat growers, its workability from the standpoint of administration, and the measure of protection that it has provided, all indicate that crop insurance may become an important part of the ever-normal granary.

Authorized under title V of the Agricultural Adjustment Act of 1938, the plan for crop insurance of wheat is relatively simple. It consists of an insurance reserve of actual wheat in storage, which is built up by premium payments of growers who insure their crops. Growers may insure either 50 or 75 percent of their average yields against all unavoidable losses. The yield that may be insured, and the premium rate that is to be paid for such insurance, are determined by actual or appraised yield and loss experience for the farm during the representative base period.

In case of unavoidable loss which reduces the insured crop below the insured amount, the grower is entitled to an indemnity from the insurance reserve sufficient to bring his actual production, plus the insurance indemnity, to the insured amount. The plan operates on an "in-kind" basis. Insurance is written in terms of bushels. Premiums and indemnities are calculated in bushels. However, for convenience, the actual payment of premiums and indemnities may be made in the cash equivalent.

Should the crop-insurance plan grow to large proportions, the automatic action of this insurance reserve as a part of the ever-normal-granary plan may contribute to a more orderly flow of wheat supplies to market. What it subtracts from the market supplies of the wheat crop in years of overproduction can be released for consumption in years of short crops.

The wheat crop-insurance program is administered by the Federal Crop Insurance Corporation, an agency of the Department of Agriculture. The Corporation directs policy making, administration of funds, and operation of the wheat reserve. All field administration of the program is carried out with the cooperation of State and county committees of the agricultural conservation program.

The wheat crop-insurance program was taken to the field in July of 1938, in the early-winter-wheat-planting areas. General actuarial data had been assembled for States and counties, but it was necessary to determine the yield and loss history for each farm for which application was made. Approximately 305,000 applications for insurance were filed by farmers. After applications were received, pre-

mium rates were computed, and on or before certain dead lines more than 165,000 growers paid premiums and obtained insurance policies. Thus, approximately 54 percent of the applications matured into policies.

About 7,500,000 Acres Covered

As of June 30, 1939, the policies issued represented coverage of approximately 7½ million acres, on some of which only part interest in the crop was insured, as only the landlord's or only the tenant's interest may have been insured. Growers in the aggregate were assured the equivalent income of a minimum production of 63 million bushels. For this protection, growers paid the equivalent of 6,769,120 bushels of wheat in premium. Policies were in force in 1,300 counties of 30 States.

The fact that 305,000 growers applied indicates that there is a widespread demand for crop insurance. It was to be expected that growers would be somewhat cautious in enrolling in the first year, since premiums required an investment ranging from one-half to 3 bushels an acre. Many growers were not inclined to take part in an experimental plan until it had been demonstrated successfully.

However, the greatest obstacle to participation was lack of wheat, cash, or credit by many growers with which to pay the premiums. This was particularly true in those areas which have, in recent years, suffered heavy crop losses and where crop-insurance protection is of greatest importance to the farmer. This situation was improved, at least for the spring wheat areas, by action of Congress in March, which made it possible for growers to obtain advances for payment of premiums to be deducted later from payments to be earned under the agricultural conservation program.

The widespread participation in the 1939 program resulted in a demonstration of the practicability of crop insurance on a Nation-wide basis. Some insurance was written in practically every community in which wheat is an important crop. This indicated that the principle of basing the rates upon the farm's experience makes the plan flexible enough to fit a wide range of farming conditions. Participation has not been limited to any one type of farm. Apparently, wheat crop insurance has about as much appeal for the farmer whose crops are diversified as it has for the farmer whose income is almost entirely dependent on the outturn of his wheat crop.

Perhaps the greatest innovation involved in the wheat crop-insurance program is the insurance reserve of actual wheat in storage, designed to protect the Corporation against loss from fluctuations in wheat prices. If the reserves were not carried in wheat, fluctuations in prices might upset the whole actuarial basis for the insurance upon which the Corporation relies to collect premiums adequate to meet losses.

Because the bulk of the crop had moved to market by the time insurance premiums were collected and because it was more convenient to pay in the cash equivalent, 99 percent of the growers paid their premiums in the cash equivalent. The proceeds were immediately invested in wheat in storage.

Location of the Reserves

It was the policy of the Corporation to locate its reserves with the best possible relationship to the areas in which the indemnities would be paid. This was limited to some extent by the difficulty of obtaining supplies of wheat and adequate storage at country points. In accordance with this policy, wheat supplies of the reserve were stored at 44 points in 10 States, under a standard storage agreement which provided for storage rates at one-thirtieth of a cent per day per bushel for the first 6 months of each year followed by 6 months' free storage.

The most critical test of crop insurance came with the adjustment of losses sustained by insured wheat growers. It was realized that inaccurate adjustments might nullify the actuarial background of the program. The field work of determining the amount of loss sustained by growers was performed by county committees with the assistance of adjusters working under their direction. Adjusters were farmers living in the counties, and were selected on the basis of knowledge of the program and farming conditions in the county.

The Corporation has made a careful study of this phase of the plan through audit and field check-ups of individual claims. It has found that most adjustments were made in a scrupulous manner, with every effort being made to measure the extent of loss exactly and impartially. Officials of the Corporation have concluded that delegation of the adjustment work to county committees is a sound practice, and results in settlements that are mutually fair to farmers and the Corporation.

Approximately one out of four growers who insured their 1939 wheat production was entitled to an indemnity as a result of crop loss. This ratio of losses is believed to be reasonably in line with normal expectations for a year in which the yield of the insured crop was approximately 10 percent below the average yield of the base period. Losses were particularly extensive and severe in five Great Plains States where the greatest acreage was insured—Oklahoma, Texas, Kansas, Nebraska, and South Dakota—where the 1939 yield was 13.5 percent below the base period average. Policies in these five States represented 37 percent of the national insured acreage, and losses on this acreage resulted in 59 percent of the total number of indemnities and 73 percent of the total bushels of indemnities.

Adjustment of 1939 crop losses was practically completed by November. The Corporation had paid indemnities totaling approximately 7,687,656 bushels on 42,420 claims submitted by insured growers, and was in the process of settling claims involving an additional 1,774,074 bushels, bringing total indemnity obligations to 9,461,730 bushels.

The wheat reserve accumulated from premium payments provided wheat for payment of 6,769,120 bushels of indemnities. As of October 31 capital funds, provided for the express purpose of balancing the reserve in years that indemnities exceed premium payments, had been used to pay indemnities representing 2,692,010 bushels,

representing an expenditure of approximately $1,430,000. In normal operation of the program, the position of the reserve will fluctuate from year to year, depending on crop conditions, but over a period that is representative of the base period, premiums paid by growers should approximately balance with indemnities they receive.

Early in the program it was discovered that for a majority of farms it would be impossible to obtain reliable and applicable annual wheat-yield records for each year of the base period. As a result, the majority of applications were submitted on the basis of an appraisal. At first, many of the county committees had difficulty in making proper appraisals because of a natural tendency to bring such appraisals near the county average figures, thus not reflecting the variation in yields and loss costs from farm to farm and year to year.

Major Change in Policy

This pointed the way to a major change in policy. It became apparent that the program should be adapted to operation largely on an appraisal instead of an historic yield basis. To meet this problem a procedure was devised by which county committees selected key farms representing a variety of land types, methods of farming, and location, which would reflect that range of experience for the county. These key farms, for which annual yield data were available, were used as guides in making appraisals, with the result that a substantial improvement was made in data submitted on applications.

It would appear that under the 1939 program there was a tendency to write insurance for somewhat higher yields and lower premium rates than accumulated actuarial data would indicate should be the case. Field representatives believe that the plan appealed more strongly in 1939 to farmers with high yields and low risks than to those on high-risk, low-yield land. If such is the case, the higher yields and low premium rates may be justified. However, there is evidence that in some counties the level of insurance was somewhat too high. This has pointed to the need for an automatic control which has been incorporated in the 1940 program. Under this method, if the aggregate of individual insured yields and premium rates is out of line with the county actuarial data, a factor is applied to adjust them to the proper level.

Also it was found that basing yields and premium rates on the past history of the farm does not take into account certain recent improvements and methods of farming in some areas, such as irrigation and summer fallow. These improved practices have in many cases been found to increase the average yield and to decrease the amount of risk involved. In order to give due weight to the use of special practices, the insurance program has adopted a special practice procedure under which the effect of certain improved methods may be measured and given due weight in determining insurable yields and premium rates for farms on which such practices are used.

It was originally anticipated that all wheat growers insuring their crop would pay their premiums at or about the time the crop was planted. At that time both the Corporation and the insured grower

are about on the same ground with respect to knowledge of the prospects of the crop to be insured. However, in the first season it was necessary to obtain yield data and to compute average yields, premium rates, and cash equivalents after the applications were received. This involved some delay and made it necessary to accept premiums on a large proportion of the applications after the crop was planted. As a result, some adverse selection of risks occurred in the winter-wheat belt.

Time of Premium Payments

It was apparent in some areas, particularly those in which premium rates were high, that growers did not pay the premiums if the prospect of the crop looked promising, but did pay if the crop appeared to have a poor start. In some cases this resulted in insurance of poor risks. In others, the selection worked against the producer since some promising looking crops on which the premium was not paid later deteriorated and resulted in an uninsured loss. This experience has shown the necessity for protection of both the individual farmer and the Corporation by requiring that all premiums be paid before the crop is seeded.

In the 1939 program it was necessary to obtain from each grower at the time of his application the necessary data for establishing his average yield and premium rate, whereas, in the 1940 program it has been possible to set up yields and rates prior to the application period for practically every wheat farm in all except some minor wheat-producing counties. These schedules of rates for individual farms have been developed largely on the basis of appraisal, utilizing key farms as guides. Because of this advance preparation of rates it has been possible prior to taking applications to get a complete picture of the yields and rates in relation to basic actuarial material and to apply automatic controls to avoid deviation from the proper insurance levels.

The period on which the insurance yields and rates are based has been extended by bringing into the actuarial data the yield experiences for the past 3 years, 1936–1938. In some counties where drought or other hazards have been unusually prevalent in recent years, adjustment to a 20-year experience has been made to reflect a more normal experience. The preparation of yields and rates in advance through the key farm system has made it possible to improve the timing of the program. All applications in the 1940 program will be taken prior to the planting of the crop to be insured. There will be no chance for either favorable or adverse selection of risks.

Whereas in 1939 several operations were involved, in the 1940 program the application is taken and the premium paid in one operation. There is no policy. The completed application becomes an insurance contract upon acceptance by the Corporation. A major improvement in the 1940 program is the facility with which producers may pay premiums. It is anticipated that the majority of the growers will take advantage of the opportunity to secure advances from future payments to be earned under the agricultural conservation program.

From the sign-up now in progress, it appears that the number of growers participating in the 1940 program will represent an increase of 100 to 200 percent over the enrollment in 1939. This gain will reflect a combination of factors: Increased understanding of the plan as a result of the demonstration on the 1939 crop; the fact that wheat crop losses, though scattered, were extensive in 1939; improvements in the program itself, which make it easier for the grower to insure; and the fact that growers may pay premiums by means of advances against payments to be earned under the Agricultural Adjustment Administration program.

The place of wheat crop insurance in the broad general program for agriculture has been clarified by the experience of the crop-insurance program in 1939. The Department has regarded crop insurance as an integral part of the broad agricultural program and not as a separate program by itself. Administration of crop insurance by State and county farm committees which also administer the Agricultural Adjustment Administration program has provided an effective and economical field force. It has resulted in a coordination of crop insurance with other programs also handled by these committees. Much of the work necessary for crop insurance can be accomplished in the same operations involved in administering other phases of the general farm program, and much of the data accumulated may be used interchangeably by the various operative agencies.

It has been a guiding policy to seek a close integration of crop insurance with other phases of the farm program, as for example, in limiting the insured production on a farm to the amount that would be produced on the acreage allotment for such farm. Farmers who take steps to conserve their soil and adjust their acreage can make sure, through wheat crop insurance, that the reward of these efforts will not be lost through unavoidable crop failure. Crop insurance combined with other phases of the general agricultural program enables growers to plan their farming operations on a long-range basis. This in itself is conducive to the development of a more stable system of farming.

The background of wheat crop insurance and its legislative history clearly implies that this program is to be regarded as a possible forerunner of similar programs for other corps. The act provides for research to determine the feasibility of extending insurance protection to crops in addition to wheat.

Accordingly, the Bureau of Agricultural Economics has studied the operations of the wheat program, particularly the application of actuarial data, and has made actuarial investigations for other crops, notably cotton, corn, and citrus fruits. It has attempted to measure the risks involved, to assemble and analyze county yields and losses, to establish an actuarial basis, and to develop suitable crop-insurance plans. In May last the Bureau outlined a suggested plan for cotton crop insurance, and in 1940 it may complete a similar proposed plan for corn.

In general, the plan proposed for cotton closely follows the basic features applied in the insurance of wheat. The program would be essentially all-risk; rates would be determined separately for each

farm; the insurance would be in kind; a reserve of actual cotton in storage would be accumulated; and the program would be administered in the field through State and county farmer committees.

The development of a program to apply to corn may involve more difficulties than for wheat or cotton since adequate yield and loss data on individual farms are not so easily obtainable and additional factors than cash sale of the crop, such as value of fodder and corn used as silage, must be considered.

TRADING IN COMMODITY FUTURES

For some of the leading farm products the marketing mechanism includes a group of contract markets for trading in commodity futures. It is important to agriculture and to the general public that these markets should be free from manipulation and should facilitate accurate and unbiased determination of prices. The Commodity Exchange Act requires that certain futures markets be so conducted. Other provisions of the act are designed to assure adequate protection to persons who make use of the markets.

To maintain the competitive nature of futures markets the Commodity Exchange Administration in December 1938 set a limit to the permitted extent of individual speculative activities. In each of the grains (wheat, corn, oats, rye, barley, or flaxseed), no one on a single day may buy or sell as a speculation more than 2,000,000 bushels of futures, and no one may accumulate an open speculative position in excess of 2,000,000 bushels on a futures market. Spreading between markets is limited to a position not in excess of 3,000,000 bushels in any one market. These provisions should help to eliminate unduly large speculative operations, such as have sometimes pushed grain prices away from their proper levels and injured farmers and consumers.

Also in December 1938 the Administration issued a formal complaint against one of the largest grain-merchandising houses in the United States, in which it charged that the firm of Cargill, Inc., one of its subsidiaries, and certain persons connected with these corporations were engaged in manipulative short selling of the 1937 December corn future on the Chicago Board of Trade, operating a corner in the 1937 September corn future, as well as rendering false reports to the Commodity Exchange Administration, and making wash sales on the Minneapolis Chamber of Commerce. This was an example of the more stringent action occasionally invoked to maintain proper conditions in the futures markets.

Free and open futures markets cannot be maintained if essential information about them does not reach the public. This is particularly true if interested parties have sole access to vital information, or even if they simply have prior access to it. Before Federal regulation of commodity exchanges began, public knowledge of futures trading was confined almost entirely to the price quotations. The Commodity Exchange Administration broadened the scope and increased the accuracy and usefulness of published data on futures trading. It made numerous studies of market operation and built

up a system for the release currently of important information about prices, volume of futures trading, quantities and grades delivered on futures contracts, and the volume of open contracts.

Data About Cotton Sold on Call

Recently the Commodity Exchange Administration began also to publish data weekly on the quantity of cotton sold on call. The call contract plays an important role in the marketing of cotton. It provides for the delivery of a specified quantity and quality of cotton, at a price which is not to be fixed until a later date. The ultimate price will be that of a designated cotton future plus a specified premium or discount; and to one party is given the right at any time to require the fixation of the contract price by means of a futures transaction. Each call contract in existence, therefore, represents an eventual transaction in the futures market.

Formerly, exclusive knowledge regarding the volume of call contracts based on different futures gave trading advantages to the possessor. Ignorance of the volume of call contracts handicapped many cotton mills and other parties to call contracts, since they had to act without knowing the volume of fixations to be expected. Complete information on the volume of call contracts was not available to any one prior to the collection of such data by the Commodity Exchange Administration. Some few individuals, however, had private access to sources that made rough estimates possible. On the other hand, the great majority of those directly interested in call contracts had to base their conclusions on guesswork. The publication of accurate information has entirely changed this situation. It promises to contribute significantly to the fair and efficient operation of the cotton market.

Fiduciary Role of Commission Merchant

In certain operations the futures commission merchant has a function similar to that of the commercial banker. He receives deposits from his customers as security for the fulfillment of contingent obligations and handles funds that belong to other people. Banks have long been subject to regulation. No comparable protection, however, was afforded to the customers of futures commission merchants until 1936. Congress then enacted the Commodity Exchange Act, which recognizes the fiduciary relation of the futures commission merchant to the funds deposited with him. It provides that he must keep such funds separate from his own assets and may not use them for his own purposes. It provides also that the money of one customer may not be used to margin the trades of another.

In the enforcement of this provision, the Commodity Exchange Administration must see that every futures commission merchant properly accounts for and properly segregates each customer's funds, so that they may be available to the customer at all times. This requires a comprehensive audit of brokers' books, similar to a bank examination. During the year nearly 800 firms submitted their

books for examination. Audits were made of all firms, some of them with numerous branch offices, that had registered with the Commodity Exchange Administration up to January 1, 1939. Staff limitations have made it impossible to examine firms as frequently as would be desirable, but this examination has led to important changes in the handling of funds. It has demonstrated its value repeatedly as a means of protecting persons who have balances to their credit with futures commission merchants.

Effects of A. A. A. on Futures Markets

Certain aspects of the A. A. A. adjustment program have had a direct effect on the futures markets. For example, the withholding of stocks under the commodity loan has reduced supplies in commercial channels. There is a fairly close relation between commercial stocks and hedging operations in futures markets. Hedging in turn is a major determinant of the volume of open contracts on a futures market. Hence open contracts tend to fluctuate with changes in supplies in commercial channels. As free stocks decline, the stocks for which protection is secured through the mechanism of the futures markets decline.

This interrelationship can be seen strikingly in cotton. Average free stocks of cotton in this country during the fiscal year 1939 were about 68 percent of similar stocks in 1938. Open contracts in 1939 averaged about 76 percent of their level in 1938. While the volume of futures trading and the volume of open contracts in cotton have declined considerably, the market has maintained its essential relation to the flow of cotton in commerce. The same is true of most of the regulated futures markets for farm products.

FARM INCOME

The cash farm income from marketings and Government payments in 1939 will probably amount to about $8,250,000,000, as compared with $8,020,000,000 in 1938 and $8,988,000,000 in 1937. Before the outbreak of war in Europe the receipts from marketings of farm products were lagging behind those in the corresponding months of the previous year, in spite of material improvement in business conditions. Following the outbreak of war the prices of many farm products advanced sharply. Receipts from marketings increased so that the total for the year will probably exceed that for the previous year. The cash income from marketings will probably amount to about $7,675,000,000, as compared with $7,225,000,000 for the previous year. Government parity payments and soil-conservation payments to farmers are expected to total about $675,000,000, as compared with $482,000,000 for the previous year.

The national income for the year is expected to be about 5 percent greater than in 1938. Industrial activitiy and urban employment have been maintained in 1939 considerably above the low levels reached in 1938. The resulting increase in nonagricultural income has increased the domestic demand for many agricultural products. Weakened

foreign demand, on the other hand, and large stocks carried over resulted in low prices in the early part of the season for many products. A few farm products were affected adversely by the outbreak of the war. These adverse effects, however, are more than offset by the stimulating effects upon prices and the purchases of many other products.

Accumulated surpluses of fats and oils depressed the price of lard and consequently to some extent the price of hogs. As a result the income from hogs declined in spite of the increase in the purchasing power of the consumers of meats. Large stocks of butter and large supplies of other fats and oils held down the income from dairy products. The advance in prices of dairy products after the outbreak of the war may be hardly sufficient to bring income from dairy products up to the level of 1938, and the income from hogs may be a little short, despite the temporary higher advance in prices.

Larger returns from cattle and lambs will contribute to an increase in income from meat animals. The income from the marketings of livestock and livestock products may total about $4.435,000,000, as compared with $4,385,000,000 in 1938.

During the depression years cash income from meat animals declined from a post-war peak in 1929 of $3,016,000,000 to about $1,158,000,000 in 1932. From 1932 through 1937 cash income from meat animals almost doubled. This recovery was due chiefly to an increase in the domestic demand for meats, the basis of which was an increase in national income and increases in pay rolls and employment. Livestock producers also received relatively large benefit payments on hogs and corn in 1934 and 1935. And in those years they received a fairly large volume of income for cattle, calves, and sheep purchased by the Federal Government as a drought-relief measure.

Generally speaking, the broad swings in recent years in the cash farm income from the three species of livestock have been similar. However, the proportion of the cash income from meat animals represented by the income from each species has changed somewhat. In the years 1925–29 the cash income from hogs averaged about 45 percent of the total income from meat animals; the income from cattle and calves was about 48 percent; and the income from sheep and lambs was about 7 percent. In the period from 1935 through 1938, cash income from hogs was about 40 percent of the total; income from cattle and calves was about 52 percent; and income from sheep and lambs was about 8 percent.

Despite a significant reduction in the income from tobacco, the income from crops in 1939 is larger than in 1938. Tobacco prices began the season on a low level because of the large supplies. The outbreak of the war caused British buyers to abandon the market for a time. This has materially reduced the income from tobacco. The recent advances in the price of wheat and some improvement in the price of cotton and cottonseed, on the other hand, have contributed materially to an increase in the income from crops.

Government activities have probably contributed more to the support of farm buying power in 1939 than in any previous year.

Direct payments to farmers will amount to about $675,000,000 as compared with $482,000,000 in 1938 and $367,000,000 in 1937. These payments have been made in part for a national service in conserving agricultural resources and in part as parity payments in making up for the abnormally low prices of many farm products. In addition to these direct payments, the Government has helped to maintain prices of several other farm products by commodity loans and by the purchase of surplus products for distribution to families in need.

Agriculture has provided an abundance of food supplies at low prices. Many persons unable to buy farm products have received high-quality foodstuffs in large volume through relief agencies. Persons with incomes have been able to satisfy their food wants with small expenditures and to devote a larger share of their incomes than usual to the purchase of other goods. Many manufacturing industries have profited by the sale of war materials to the Orient and to Europe. Expansion in industrial activity during the year has been due both to foreign armament demands and to increased domestic activity in urban residential building, in automobile and associated industries, and in textiles.

FARM PRODUCTION IN 1939

Crop reports in October indicated a combined production of all crops somewhat smaller than that of 1938 but about 5 percent larger than the 10-year (1928–37) average. In this average period there were several severe drought years. However, the aggregate production of all crops in 1939 was slightly above the average for the predrought years.

Feed-grain production, though slightly smaller than in 1938, was considerably above the 10-year (1928–37) average. The total supply of feed grain on farms October 1, including stocks and crops then not yet harvested, was about 4 percent above the large supply on that date in 1938. Nearly 8 percent of the supply was sealed corn held under Government loan. Excluding sealed corn, the total supply of feed grains per unit of livestock on hand was just about equal to the average supply during the predrought years. Livestock numbers were about 8 percent greater than in the latter months of 1938. Hay supplies for the country as a whole were enough for ordinary winter and spring feeding, and in fact were expected to provide a somewhat larger than average carry-over.

Production of the main food crops was ample, despite insufficient rainfall in some areas. Estimates in October of the major food grains (wheat, rye, rice, and buckwheat) showed about average aggregate production. Moderately small production of potatoes was about offset by a larger than usual production of sweetpotatoes. There was large production of beans, peanuts, sugar beets, and sugarcane. Fruit production, both deciduous and citrus, gave more than the usual per capita supply and the production of fall vegetables was adequate for current consumption and winter storage.

Corn production was estimated in October at approximately 2,500,000,000 bushels, as compared with 2,542,238,000 in 1938 and a

10-year average of 2,309,674,000 bushels. Several Corn Belt States harvested record corn yields. The yield per acre for the country as a whole was slightly larger than in 1938. The harvested corn acreage in 1939 was 90,734,000, as compared with an average of 103,419,000 in the 5-year period 1928-32. The harvested corn acreage in 1939 was 98,145,000.

Wheat production was about 739,445,000 bushels—approximately 21 percent less than the production of 930,801,000 bushels in 1938. The 10-year (1928-37) average wheat production was 752,952,000 bushels. The acreage of wheat harvested in 1939 was about 22 percent smaller than that in 1938.

The oat crop was 941,230,000 bushels—considerably less than the 1938 production of 1,053,839,000 bushels and also considerably below the 10-year average of 1,049,300,000 bushels. Acreage in oats was about 5 percent smaller than in 1938, and the yields as reported in October were smaller. The barley crop was above the 10-year average.

Cotton production, according to the October crop report, was 11,928,000 bales, or slightly smaller than the crop of 11,943,000 bales in 1938 and considerably below the 10-year average of 13,800,000 bales. The acreage in cotton was about the same as in 1938 and considerably below the 10-year average.

Tobacco production, as a result of record high yields, was larger than that of 1938 and above the 10-year average.

The acreage of all crops for harvest in 1939 was smaller than in 1938 and below the 10-year average. It was slightly over 316,000,000 acres, as compared with about 328,000,000 acres in 1938 and a 10-year average of approximately 332,000,000 acres. The decline was the result principally of a sharp reduction in the wheat acreage and of significant declines in the acreages of corn and oats. There were partly offsetting increases in the acreages of other crops, notably flaxseed, which was more than double the 1938 acreage.

Nearly all crops showed higher than average yields. The exceptions were rye, buckwheat, grain sorghums, peanuts, and broomcorn. The yield per acre of wheat as reported in early October was just equal to the average.

WHEAT PRODUCTION AND MARKETING

The world wheat supply for the year beginning July 1, 1939, is about 5,464,000,000 bushels, which is the largest supply in the history of the world. Liverpool prices during August 1939 fell to the lowest levels in several hundred years. Our prices have been held above world levels as a result of the reduced production in 1939 and the wheat-loan and export programs. This relationship has continued even after the outbreak of hostilities in Europe; domestic prices are still little above the loan values.

The acreage seeded for the 1939 crop was slightly less than 65 million acres, as compared with 80 million for 1938 and 81 million for 1937. This reduction was brought about primarily by the large compliance with the acreage allotments under the 1939 agricultural-con-

servation program. The domestic production was 739 million bushels in 1939, as compared with 931 million in 1938. Yields per acre for the two crops were approximately the same.

Wheat supplies in the United States for the year beginning July 1 are estimated at 990 million bushels, or about 100 million less than the supply for 1938. If domestic disappearance is equal to the 10-year (1928–37) average of 685 million bushels, this would leave 305 million bushels for export and carry-over during the current marketing year. Exports from July 1 to the middle of October amounted to about 20 million bushels. Even though our exports for the year ending June 30, 1940, should amount to only 50 million bushels the carry-over next July would be about the same as it was on July 1, 1939.

For the year ended June 30, 1939, sales of wheat and flour for export totaled about 118 million bushels, of which about 107 million were exported before the end of the fiscal year. These sales included 90 million bushels of wheat and 28 million bushels of wheat in the form of flour. Of the total sales for export, sales of approximately 94 million bushels were assisted by the Federal export program. These sales consisted of about 70 million bushels of wheat in the form of grain sold by the Federal Surplus Commodities Corporation for export and 24 million bushels of wheat in the form of flour on which an indemnity was paid. During the last part of the fiscal year, the Federal Surplus Commodities Corporation purchased 4.4 million bushels of wheat from the Commodity Credit Corporation under the wheat-loan-liquidation program. This wheat is not included in the above figures. With the exception of this wheat bought from the Commodity Credit Corporation, purchases and sales of wheat by the Federal Surplus Commodity Corporation were in balance at the end of the year.

Our net exports for the year ended June 30, 1939, are considered to be a fair share of the world shipments of approximately 600 million bushels for that year. It was for the purpose of securing approximately this share of the world export trade that the Federal Surplus Commodities Corporation financed the movement of 94 million bushels of wheat during the 1938–39 marketing year. This export program has been continued since July 1, 1939, but with the existing international situation, sales since September 1 have been at a greatly reduced volume. Since September 1 payments in the amount of about 25 cents per bushel have been made in order to assist in the export of a small quantity of wheat which has gone principally to Central and South American republics. During August it was necessary to make payments averaging nearly 36 cents per bushel. During the 1938–39 marketing year payments under the export program averaged about 29 cents per bushel.

Loans on 1939 Wheat Crop

Loans on the 1939 crop of wheat have been offered to growers who kept their seedings within their 1939 wheat-acreage allotments at values calculated to average between 54 and 55 percent of the parity price prevailing at the beginning of the marketing year. The loan

values to farmers for wheat stored on farms and at country shipping points have averaged about 7 cents higher than the values established for 1938. The loan program for 1939 was announced well in advance of the movement of the crop, and with larger participation in the wheat-acreage allotments more growers were eligible for loans than in 1938. It is anticipated that at least 200 million bushels of wheat will be brought under the 1939 loan, as compared with 85 million in 1938.

From the standpoint of supplies, the wheat situation is reasonably satisfactory; 1939 supplies are sufficiently large to provide an ample carry-over next July but do not represent a burdensome or unmanageable surplus. From the standpoint of prices, however, wheat growers have not as yet reached parity. Producers who have cooperated in the agricultural conservation, parity, and loan programs for 1939 have received approximately 88 cents per bushel. This includes an average loan rate of 60 cents and conservation and parity payments of 28 cents. This is still short of the parity price of $1.10, but is far in excess of what these growers would have received if they had been required to sell their wheat on the basis of prices that have prevailed outside of the United States.

COTTON-ADJUSTMENT AND EXPORT PROGRAM

Cotton producers are going through one of the most critical periods in the history of cotton production in the United States. The prices received by domestic producers for their record 1937 and their 1938 crop were 6.2 to 8.5 cents below parity and were the lowest, with the exception of the prices of the 1931 and 1932 crops, since the outbreak of the World War. Furthermore, in consequence of an effort to adjust production more nearly to world takings, the quantity of cotton produced in 1938 was nearly 2 million bales less than the average for the 10 years ended 1932. The combination of reduced production and low prices resulted in a gross farm return from lint cotton in 1938 only about two-fifths as large as the average during the twenties and only slightly above that of the 1931 crop, when prices were the lowest in nearly 35 years. The total returns from the 1938 crop, even with payments to farmers under the Agricultural Adjustment Act included, were only half as large in relation to the national income as the average for the 5 years immediately prior to the World War.

Prices and farmers' returns for the 1938 crop would have been even lower had the Government's cotton-loan programs not withheld from 7 to nearly 11½ million bales of cotton from regular marketing channels. Without the supporting influence of the Government loans, the record-breaking supply of cotton and the disrupted state of world trade probably would have depressed domestic prices to the level of 1931 and 1932. But the loan by itself, while it helped to maintain domestic prices, had the effect of impounding large supplies and of restricting the free flow of American cotton into export.

Impounding of these stocks was one of the factors that restricted exports. (1) It held the price of American cotton above its normal

relation to the price of foreign growths, and thereby gave foreign growths a price advantage in the foreign cotton: (2) by maintaining spot prices at or above the loan level while futures quotations declined, the normal relationship between spots and futures was inverted. This made hedging difficult. Foreign merchants and manufacturers followed a 'hand-to-mouth buying policy in the 1938–39 season and allowed their stocks of raw cotton to decline.

Influence of Substitute Fibers

The continued increased use of substitute fibers and other materials, especially in the foreign countries which do not produce cotton, has tended to further restrict our exports. The difficulties foreign countries have experienced in getting exchange with which to pay for their imports, nationalistic trade policies of certain foreign countries, abnormal domestic conditions such as existed in Japan, China, and Spain, and large supplies of foreign growths of cotton brought about by the expansion of acreage and production abroad in the last decade or longer in some countries, are some of the other factors which caused our exports during the 1938–39 season to drop to 3,300,000 running bales or to a level 58 percent below the 10-year (1923–32) average of 7,900,000 bales, or to the lowest level in nearly 60 years.

The extremely small exports in the face of record-breaking supplies, the accumulation of more than 11 million bales of cotton under Government loans, and the necessity of retaining a large export market for cotton as the only alternative to painful and costly adjustments in our national economy made it imperative to change certain aspects of the cotton program. It was evident that a program which permitted more cotton to pile up in the loan stocks and a continued reduction in our share of the world market would surely lead to disaster. The Seventy-sixth Congress considered several different proposals for dealing with the situation. Many growers and others interested turned to a revival of the processing tax-and-benefit payment plan as a means of raising the farmer's price on the domestically consumed portion of his crop, but the support for this plan was not effectively organized.

One proposal that received considerable support involved the fixing of prices to domestic consumers. This proposal would either require the policing of millions of transactions, or the taking over by the Government of a large part of the functions now performed by the cotton merchants of this country. Hence opposition to it developed. The problem before Congress finally became a practical matter of choosing on the one hand between making payments on exports in order to offset some of the undesirable effects of the loan, and on the other hand of permitting more cotton to accumulate in the loan stocks with adverse effect on the export situation. The plan for making export payments was approved, and funds were appropriated for this purpose.

Export Gain Through Export-Payment Plan

The export-payment program, which became effective July 27, 1939, provided that exporters would be paid 1.5 cents per pound on the exports of raw cotton and a somewhat comparable amount on the exports of cotton textiles. This payment has undoubtedly caused prices of American cotton in foreign markets to be lower absolutely as well as in relation to the prices of other cottons, than they would have been otherwise. Consequently, the effect on exports is almost exactly the opposite of the effect of the loan program. There is no doubt that the export-payment plan has been an important factor in the sharp increase in exports during the first 4 months of the current season. Moreover, by stimulating exports and decreasing the supply of American cotton available to domestic manufacturers, the plan has caused the domestic prices of cotton to be higher than they would have been otherwise.

It is hoped that the need for making export payments will be temporary. Nevertheless, since the United States can hardly be expected to restrict further its acreage and production, the payments may have to be continued until some other means can be found of assuring the United States a fair share of the world's cotton market. One way of making the export-payment program temporary would be the conclusion of an effective and equitable international cotton agreement. Such an agreement would assure each exporting country its share of the world market, and would help also to support a reasonable level of world cotton prices. As a primary step in bringing about such an agreement, the United States took the initiative for arranging a preliminary meeting of representatives of the various cotton-exporting countries. This meeting was held in Washington from September 5 to 9, 1939. Practically all of the important cotton-exporting countries were represented.

Movement for International Collaboration

In this time of world turmoil when the guns are thundering again, it is appropriate, rather than strange, that the nations should reconsider international collaboration in economic affairs.

So far as the immediate cotton situation is concerned, the events of recent months cannot be interpreted optimistically. In fact, the world cotton situation has been made more difficult. The possibilities of utilizing in the immediate future the burdensome supplies of cotton have become poorer rather than better. It seems likely that any increased use of cotton for military purposes in the combatant countries will be much more than offset by decreased use for ordinary purposes. Also, the problem of transportation from exporting countries to importing countries has become acute.

It is heartening, therefore, that there should be evidence of a continued desire to work out international problems around the conference table. The recent conference on the world problems of cotton was the latest attempt to find a cooperative way out of the economic dilemma which confronts producers of many raw materials—rubber, wheat, and sugar, to mention some typical ones other than cotton.

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One general consideration affects them all, namely, the trend evident since the World War, and likely to be intensified by the new outbreak of hostilities, toward nationalism and self-sufficiency. It is especially strong in highly industrialized western Europe, where many countries are trying to grow their own wheat, sugar, and other commodities. Even in peacetime they subsidized their own production and shut out the production of other countries. Renewed war will undoubtedly confirm the tendency.

The World Maladjustment in Cotton

Any generally satisfactory solution for cotton's troubles must be on an international basis. The outstanding facts of the world maladjustment are: (1) The world carry-over of cotton into the present marketing season totaled 22 million bales, or in other words there was on hand at the beginning of the season almost enough cotton to take care of the world's consumption requirements during the present year without drawing on the new world crop; (2) the price of cotton on the world market is extremely low, chiefly as a reflection of the huge carry-over; (3) world trade in cotton is tending to decline, as a result partly of the increasing use of substitute materials in certain countries and partly because some countries that formerly imported cotton are now producing enough or more than enough for their own needs; (4) in spite of the great carry-over and the low prices, world production continues at a high level. Reduced production in the United States has been more than offset by increases in other countries. A large part of the increased foreign production has taken place in four countries, the Soviet-Union, China, Uganda, and Brazil.

Nevertheless, the United States does not contemplate withdrawing from the world market. Over a long period more than half our total output of cotton has been exported, and the economy of the South rests on the production of cotton. Probably we have gone as far as possible in the reduction of the cotton acreage, which this year is less than 25,000,000 acres as compared with an average of 41,000,000 acres in the period 1928–32. In short, the gradual development of international cooperation along commodity lines is essential to the solution of our cotton problem.

The cotton loans, the export-payment program, and the efforts to bring about an international cotton agreement are only a few of the activities undertaken by the Federal Government to aid cotton farmers and to bring about a better national economic balance.

The Conservation Program

The primary domestic effort to assist cotton growers again centered in the agricultural conservation program, in which more than 90 percent of all cotton producers participated. Under the conservation program, cotton farmers planted well within the national allotment goal of 27,500,000 acres. Payments were made to cooperating farmers to assist them in adopting soil-conservation and soil-

building practices. In addition to these payments, price-adjustment, or parity, payments were also made to cooperators.

Marketing quotas, which were approved by 84 percent of all producers voting in a referendum, contributed to the orderly marketing of the crop and helped protect cooperating farmers from the effects of overplanting of allotments by the comparatively few noncooperators. Under the marketing-quota program, which can be placed in effect only when supplies are excessively high and only when approved by two-thirds of the producers voting, penalties are assessed on marketings in excess of each producer's quota.

Other efforts to aid cotton farmers include:

(1) The effort to find and develop new uses for cotton and to expand consumption in the older and more customary uses; (2) expanded efforts to develop improved varieties in the various regions of the Cotton Belt; (3) the encouraging of farmers to plant such varieties and, in communities where it is practical, to plant only one variety; (4) increased efforts to determine and bring about greater use of improved methods of operating cotton farms; (5) increased activity designed to encourage better harvesting, ginning, packaging, and marketing of raw cotton; (6) rehabilitation loans to farmers driven from their land because of inadequate acreage, overburdening debts, and the like; (7) loans to selected tenant farmers for the purchase of farms for their own; (8) trade agreements designed to provide a greater flow of international trade and increased ability of foreign countries to purchase American products including cotton; and (9) the exchange or sale of large quantities of American cotton to certain foreign countries with the provision that this cotton cannot be used for 5 years or more except in the case of war.

Cotton Income and Price Outlook

Indications are that in 1939 the cotton farmers will receive directly or indirectly from cotton an even smaller proportion of the national income than they received in 1938, and the number of people on cotton farms is larger now than before the war. As compared with the 1920's, the 1939 calendar year income from cotton is likely to show a decline of more than 60 percent. This reflects the combination of lower prices and reduced production. On the other hand, the combined index of the prices paid by farmers for commodities and of interest and taxes was one-fourth higher (August 1939) than in the 5-year pre-war period. Low prices received and relatively high prices paid mean hard times for cotton farmers.

Briefly, the position is unfavorable in volume of sales, in costs of production, and in prices received. Cotton farmers produced nearly 3 million bales less cotton in 1939 than they produced on the average in the 5 years immediately prior to the World War, and their per-unit production costs were higher. The weighted average index of the prices of the principal factors used in cotton production was slightly higher than that in the pre-war period. The price situation has been described. The estimated average yield per acre of the 1939 crop for the United States was 25 percent higher than in

the 5 years 1909–13, and much higher than in most years prior to 1931. Continued emphasis on soil conservation, soil building and other cultural practices, and the development and use of improved varieties may raise the average yields still higher in the years immediately ahead, and should reduce the costs of production. This is the one notably good feature of the situation. By itself, it cannot counteract the unfavorable features.

Need for Continual Adjustment Efforts

Continued efforts to improve the situation are essential. Even with the 1939 domestic acreage restricted to a level below which it seems unwise to go, our production was about equal to the probable world consumption of American cotton. Consequently, there is little prospect of any considerable reduction in the record high world carry-over of American cotton during the current (1939–40) marketing season. This amounted on August 1, 1939, to nearly 14¼ million bales. Except for the fact that the United States Government is now holding something over 10 million bales of this huge carry-over, prices and income received by domestic producers would be considerably below the prevailing levels.

Including stocks held by foreign governments as well as United States Goverment-financed stocks, the total world supply of American cotton for the current season is slightly over 25 million bales. This is only about 1 million bales, or 4 percent, less than the record high world supply of American cotton in 1932–33, and 5 million bales, or one-fifth, larger than average supplies in the 10 years immediately prior to 1933. Moreover, the estimated world supply of non-American cotton for the current season is larger than the 10-year (1923–32) average by about 8 million bales, or nearly 50 percent. However, while the world carry-over of foreign cotton has been reduced from the record carry-over on August 1, 1938, it is still well above the 10-year average.

Foreign production has been definitely on an upward trend in recent years. While production this year and last is down to 16 million bales, in the two seasons 1936 and 1937 foreign countries raised more than 18½ million bales.

Supply and Consumption

The total supply of all commercial cotton for the current season is now estimated at nearly 50 million bales and is only slightly less than the record supply of the preceding season. It is more than 14 million bales greater than the 1923–32 average. The indicated supply is made up of the carry-over on August 1 of a near-record high of about 22 million bales and the indicated world production of about 27½ million bales. Should world mill consumption of all commercial cotton for the current season approximate the 28 million bales consumed during 1938–39, it would exceed world production of such cotton by about one-half million bales and reduce the world carry-over accordingly.

In view of the disturbed political and economic conditions throughout the world, however, it seems unlikely that consumption will materially exceed that of the past season. It may fall below it by at least a small amount. Even a considerably larger consumption than in 1938–39 would reduce the near-record world carry-over comparatively little. The problem should be attacked through international cooperation. If a successful international agreement among the principal cotton-producing nations were combined with a processing tax-and-benefit payment plan in the United States such as existed under the first Agricultural Adjustment Act, conditions among the American cotton producers might become substantially better.

TOBACCO

The market for the most important types of tobacco is not favorable this year. Supplies of flue-cured and burley, the two major kinds of tobacco, have increased to well above normal levels. Flue-cured tobacco already has been adversely affected by curtailment of purchases for exports because of the war in Europe, and fire-cured, dark air-cured, and Maryland tobacco may be similarly affected. The situation for the cigar types, as a whole, appears to be better. The crops are of relatively good quality and demand is favorable.

An extremely large-flue-cured crop this year resulted in a 200-million-pound surplus and a price of about 15 cents per pound as compared with an average price of 22.2 cents for the 1938 crop. This lower price existed from the beginning of the marketing season. On September 8, following the outbreak of the European war, buyers for the British trade, who usually take about one-third of the flue-cured crop, withdrew from the market. Purchases for the British trade were stopped because of exchange restrictions imposed by the British Government. This development made an already serious situation critical. Then the domestic tobacco trade closed the markets, in order to give time for the development of plans to prevent a complete collapse of prices.

These plans included a referendum on marketing quotas for 1940, and Government financing of the grades normally taken by the British trade. Quotas were approved by farmers on October 5, and a purchase-and-loan program for export grades went into operation when the markets were reopened on October 10, after a marketing holiday of almost a month. Prices since that date have been maintained at about the levels prevailing before withdrawal of buyers for the British manufacturers. The 1940 flue-cured tobacco quota will total approximately 660 million pounds.

While the supplies of burley tobacco are not so large in relation to consumption as those of the flue-cured, they are continuing to increase. This is the third consecutive year that burley production has exceeded consumption, and the supply is near a record level. Because of the excessive supplies, a quota was proclaimed on October 29, and burley growers, voting in a referendum on November 21, favored quotas for 1940. The 1940 burley quota, after increases for small producers, will total between 315 and 320 million pounds.

Supplies of other kinds of tobacco—fire-cured and dark air-cured, Maryland, and cigar filler and binder—are more nearly in line with demand than flue-cured and burley tobacco supplies. Consequently, the proclamation of quotas for these tobacco types was not necessary.

THE LIVESTOCK SITUATION

The position of the American livestock industry in foreign trade has changed tremendously in the past 40 years. In the latter part of the nineteenth century and in the early years of the present century the United States exported large quantities of beef, pork, and lard, and large numbers of cattle. In the 5-year period 1900-1904, our net exports of beef and pork plus the meat equivalent of net exports of live cattle were equal to about 13 percent of our total meat production. Subsequently, however, exports of cattle and beef largely disappeared, and export of pork and lard also declined. After 1912 we began to import live cattle in increased numbers.

Our exports of meats recovered during the World War, but after the war the trend was downward again. Exports of cattle and beef have been insignificant in most of the post-war years, and those of pork and lard have decreased materially. Except for pork and lard, livestock producers have had little direct interest in foreign markets in recent years, but they still have an important indirect stake in the foreign market for American farm products generally. Production of feed crops and livestock is probably the chief alternative for our cotton and wheat. Permanent shrinkage in the foreign outlet for wheat and cotton may tend to increase livestock production in certain areas.

Since 1900 the trend in total meat production has been upward, as a result of an increase in pork, lamb and mutton, and veal. Beef production in this period has been stable. Meat consumption also has tended upward since 1900; the rate of increase has been somewhat greater than that in meat production, because meat exports have declined. Nevertheless, the increase in meat consumption has not kept pace with the increase in population; in other words, per capita meat consumption has declined, mostly in beef.

In any one year the total domestic consumption of meat, a perishable product, largely represents the production less the exports. In some years imports add a relatively small volume to the domestic consumption.

Two factors chiefly account for the downward trend in meat exports which began in the first decade of the present century and got under way again after the World War: (1) Livestock production increased in Europe and in the Southern Hemisphere and reduced European requirements for United States meats, and (2) the domestic market for meats expanded as a result of increases in population and in consumer buying power.

Prior to 1900 meat production increased more rapidly than population in this country; since then, as already indicated, the rate of increase in population has been greater than that in meat produc-

tion. Other factors have been important in recent post-war years, among them restrictions placed on meat imports by various countries.

It seems improbable that the United States will soon regain an important position as an exporter of meats, although some increase in exports may occur as a result of the war. Meat production in Europe and in Southern Hemisphere countries, except perhaps temporarily during the war, seems likely to be well maintained. No expansion seems probable in the demand for meats in Europe, where population is either stable or declining. On the other hand, the ratio of meat production to population in the United States will probably continue to decline, and the domestic demand will be strong relative to the foreign demand.

Trends in Cattle Numbers

Numbers of all cattle in the United States reached a cyclical peak in 1934. The total of 74,300,000 head on January 1 of that year was slightly larger than the previous peak in 1918, and was the largest ever reported. The number of cattle other than milk cows at the beginning of 1934 was about 4,000,000 smaller, or roughly 8 percent, than at the previous peak in 1918.

From 1867 to about 1918, the trend in beef-cattle numbers, except for cycle changes, was upward. The increase, especially marked in the years before 1900, reflected chiefly the westward expansion of agriculture and the growth of the livestock industry in the Corn Belt and in the Western States. Since 1918 the trend in beef cattle appears to have been slightly downward, although the period is too short to establish a trend definitely.

All of the cyclical variation in cattle numbers in the last 50 years has been in beef cattle. The number of milk cows at the beginning of 1934 was nearly 27,000,000 and was about 5,400,000 larger than in 1918. The number of milk cows increased steadily from 1867 to 1934, in response to the increase in population and the expanding demand for dairy products.

Cattle numbers were sharply reduced during 1934 by severe drought and feed shortage. Even without the drought the peak of the last cattle cycle probably would have been reached in early 1934 or a year later. Because of the drought, however, the downward phase of the cycle, which probably would have lasted 6 or 7 years, lasted only about 4 years. Between 1934 and 1938, the number of dairy cows decreased 2 million and the number of other cattle about 6 million. Practically all of the reduction in both dairy cows and other cattle was in the States west of the Mississippi River, where the effects of the 1934 and 1936 droughts were very severe. Cattle numbers at the beginning of 1939 were larger than a year earlier; the number on January 1, 1940, will show a further increase.

The trend in cattle numbers during the next few years probably will be upward. Much of this increase will be west of the Mississippi River, where cattle numbers have been reduced. Increases probably will be only moderate in the States east of the Mississippi

River, because cattle numbers there are relatively large. In the Cotton Belt, where there is definite need for more livestock products for home use, some desirable increases may occur as a result of the added acreages available under the conservation programs. However, the handicaps to livestock production are serious in the Southern States and no very rapid increase is likely.

Hogs

From the late 1860's until about 1923, the trend in hog production was sharply upward; the number of hogs on farms increased from about 34 to 69 million. Most of the increase was in the Corn Belt. There was considerable variation in hog numbers around the upward trend. From 1924 through 1933, hog production was relatively stable. Further expansion in the western Corn Belt was offset partly by decreases in other areas.

From 1933 to 1935 hog production was reduced greatly, largely as a result of feed shortage caused by drought. Some reduction came as a result of the agricultural adjustment programs. The annual pig crop declined from 84,200,000 head in 1933 to 55,000,000 head in 1935. Nearly two-thirds of this decrease was in the western Corn Belt, where the drought of 1934 was severe. There was severe drought again in 1936, and hog production made little increase until 1938. Good corn crops in 1937 and 1938 caused a substantial gain. Combined spring and fall pig crops in 1939 will be about 83,000,000 head or slightly more than the predrought (1929–33) average.

The pig crop in the western Corn Belt will be less than the predrought average; about 34 million head as compared with 41 million head in the 1929–33 period. In all other regions the number of pigs raised in 1939 will be greater than in the years just before the drought; 49 million for 1939 as compared to 39 million in the 1929–33 period. In the next few years some further increase in production may occur in the western Corn Belt. It is doubtful if there will be any significant increase in any other regions. This indicates need for continued adjustment in the acreage of feed crops, as a means of stabilizing livestock supplies.

Sheep and Lambs

Sheep produced in this country may be separated into two rather distinct classes—native sheep, raised mostly in small flocks in the farming areas of the East and the Middle West; and western sheep, raised mostly in large bands in the large pastures and range areas of Texas and the Western States.

The trend in sheep numbers for the country as a whole in the last 70 years has been neither upward nor downward. Up to about 1910 the trend in stock sheep in the Western States was upward; in the native States the trend was downward. From 1911 to about 1923 the trend was downward in both areas; from 1923 to 1931 the trend was upward in both areas, with a sharp increase in the Western States. Since 1931 the total number of sheep in the entire country has not changed greatly.

There have been marked differences, however, in the trends since 1931 in sheep numbers among the various States. In the Western States, excluding Texas, numbers have decreased rather sharply since 1931; in Texas sheep numbers have increased. However, the number of sheep in the Western States on January 1, 1939, was larger than on January 1, 1938. The reduction in this area from 1931 to 1938 resulted from deficient precipitation and poor ranges, from financial difficulties during the depression years, and from decreases, actual and prospective, in the number of sheep permitted to graze on the public domain and in national forests.

In the native States sheep numbers have not changed greatly since 1932; they have fluctuated around 14,000,000 head. For the country as a whole, stock sheep numbers reached a peak of about 48,400,000 head in 1934, and then declined to about 46,400,000 in 1936. On January 1, 1939, the number had increased to about 48,000,000. Some increase in stock sheep numbers may occur in the native States also in the next few years, because sheep husbandry fits in with the shift from grain crops to hay and pasture.

Stock sheep numbers at the beginning of 1940, however, probably will be no larger and may be smaller than a year earlier. Drought conditions in the Western States and Texas probably will prevent further increases this year. If drought does not recur, the trend in the Western States may be moderately upward in the next few years; likewise in Texas, where much of the expansion in recent years has been outside the main sheep area.

Consumer Demand for Meats

Changes in consumer demand for meats and other livestock products have been much greater in the last 30 years than have changes in the supply marketed. Variations in prices and incomes received by livestock producers have chiefly reflected changes in industrial activity and employment and in consumer incomes generally. From 1929 to 1932, in which period the total national income was reduced about 40 percent, cash income from meat animals dropped about 60 percent. In the period from 1932 through 1937, during which the total national income increased about 40 percent, cash income from meat animals nearly doubled.

Aggregate payments received by farmers for slaughter livestock are determined by the total retail expenditures for meats, less the charges for processing and distribution. Total retail expenditures for meat increase and decrease with consumer incomes and charges for processing and distribution tend to change slowly. Consequently, large supplies bring lower per unit prices and profits to producers are correspondingly reduced. Fluctuations in livestock production are largely the result of wide swings in feed grain supplies and prices. Through the stabilization of feed grain supplies under the ever-normal granary, added stability can be given to the livestock industry and the wide swings in livestock prices that have been characteristic of the past can be minimized.

Changes in consumer demand are reflected in somewhat larger percentage changes in the cash income from meat animals. In the next

few years, changes in the cash income from meat animals will depend largely on changes in consumer buying power, although sharp changes in production may affect the result. Increased industrial activity and employment, with increased consumer buying power, will result in improvement in prices and incomes received by producers of livestock and livestock feed.

THE CORN-HOG SITUATION

Corn and hog prices declined after 1929 far more than the average of all farm prices. This was the result mainly of shrinkage in the export outlet for hog products. Our exports of hog products in 1932 amounted to only about 4,200,000 hogs, as compared with about 8,700,000 from 1920 to 1929. The decline represented about 10 percent of the annual inspected hog slaughter; it forced increased quantities of pork and lard into the domestic market. There was a big decline in the number of horses and mules on farms from 1920 to 1933, which released about 180,000,000 bushels of corn annually for hogs, cattle, and sheep. Added to the decline in exports, the amount of corn thus released for food for domestic consumption reached about 275,000,000 bushels annually, or about 11 percent of an average corn crop.

In 1934 and 1935 programs for adjustments in corn acreage and in hog production were in operation under the first Agricultural Adjustment Act. They followed an emergency program started in 1933. The adjustment program caused farm income from corn and hogs during the 4 years, 1933–36, to be nearly 500 million dollars, or nearly 15 percent larger than it would have been without the programs. When the United States Supreme Court pronounced the original basis of the programs unconstitutional, Congress authorized another approach. Under the Soil Conservation and Domestic Allotment Act of 1936, it encouraged farming methods to reduce soil depletion and to build up soil fertility. This was not sufficient, however, to prevent excessive supplies and low prices. Accordingly, Congress enacted the Agricultural Adjustment Act of 1938, which authorizes more direct means to effect necessary adjustments in corn acreage.

As defined in the act, the commercial corn area covers the Corn Belt of the Nation from Ohio to Kansas, and includes at least part of the counties in each of 12 Central States. A corn-acreage allotment is determined annually for this area and apportioned to the corn growers. It aims at a total supply of corn equal to 110 percent of a normal year's consumption and exports. The determination is based on normal yields in the commercial corn area, normal production in the rest of the Nation, and the expected carry-over. Outside the commercial corn area there is no direct corn-acreage adjustment; but corn is included among the general soil-depleting crops. Except on farms where larger acreages of home food and feed crops are needed, farmers must make an adjustment in general soil-depleting crops to earn maximum payments under the A. A. A. program.

The total acreage of corn for harvest in 1939 was about 90,700,000 acres, as compared with an average harvested acreage of about 103,400,000 acres in the period 1928-32. This reduction was nearly all in eight Corn Belt States: Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Ohio, and South Dakota. The corn acreage of the Corn Belt in 1939 was about 13,000,000 acres less than the 1928-32 average. Outside the Corn Belt, the 1939 corn acreage was about 1,000,000 acres above the 1928-32 average, though there was a substantial decline in Colorado and Oklahoma.

Corn Acreage and Yields

Much of the decrease in the corn acreage of the North Central States is clearly attributable to the conservation and adjustment programs. In Kansas, Missouri, Nebraska, and South Dakota other causes contributed to the reduction. In some of these States droughts caused some shift to hardier feed crops such as sorghums. Favorable wheat-growing years later caused some shift to wheat. Crop acreages taken out of corn have been shifted for the most part, however, to grasses, hay crops, and soybeans.

Corn yields per acre have been exceptionally high during the last 3 years. They have held the total production almost up to the 1928–32 average. Corn growers in 1938 produced about 2,542,000,000 bushels from 91,800,000 acres, as compared with an average production of 2,554,000,000 bushels from 103,000,000 acres in the period 1928–32. This year the indicated production as of October 1, is 2,532,000,000 bushels from 90,700,000 acres. The indicated yield for 1939 is 27.9 bushels per acre, as compared with an average of about 25 bushels for the period 1928–32. The average corn yield in 1938 was 27.7 bushels, and in 1937 it was 28.2.

Three factors mainly account for the higher yields: (1) Increased use of hybrid seed, (2) favorable growing conditions, and (3) withdrawal of the poorest acres from corn. Practically no hybrid seed was used in the period 1928–32. In 1939 farmers in the 12 North Central States and Kentucky planted more than 40 percent of their cornland to corn hybrids, or about 24,000,000 acres, as compared with 17,000,000 in 1938, and 500,000 acres in 1935. The proportion of the 1939 corn acreage planted to hybrids was 75 percent in Iowa, 65 in Illinois, 60 in Ohio and Indiana, 50 in Minnesota and Wisconsin, and 5 percent in North Dakota and Kentucky.

Experimental evidence indicates that yields are from 10 to 15 percent higher wth hybrids than with open-pollinated corn. In several States, probably because of good weather, the yields have increased by higher percentages. In Iowa, for example, the indicated yield for 1939 is 49.5 bushels, as compared with 37.8 bushels in the 1928–32 period. Similar gains have been recorded in Illinois, Indiana, and to a lesser extent in other Corn Belt States. These higher yields mean lower unit costs of production and reduced acreage requirements. They enable farmers to conserve soil. The resulting competitive advantage to Corn Belt farmers is considerable. Producing their corn on fewer acres, they save labor and expose less soil to leaching and

erosion. They find it necessary, however, to make greater adjustments in the acreage they devote to corn. For this reason, and because large supplies have accumulated from the three recent large crops, the 1940 corn acreage may be below that of 1939.

The Corn Loans

As directed by the Agricultural Adjustment Act of 1938, the Commodity Credit Corporation makes loans available to corn growers who participate in the conservation program. The loans are designed to build up an ever-normal granary of corn. Loan rates to farmers in the commercial corn area are set at rates from 52 to 75 percent of the parity price of corn, depending on the size of the crop. The act provides for higher loan rates for small sized crops than for large crops. This loan program enables farmers to store excess supplies of corn in good years for use in years when crops are poor. It discourages livestock production from excess corn. The supply stored in the ever-normal granary is available for emergency use, either in drought years or when for any reason the demand for livestock products increases exceptionally. Farmers are encouraged to keep the ever-normal granary supplies on their own farms.

In 1938–39, loans were made available to cooperating farmers in the commercial corn area at 57 cents a bushel. Farmers placed about 227 million bushels under loan in 1938; in addition, they resealed some 30 million bushels of 1937 corn placed under loan the year before. Throughout the season the loan rate was considerably higher than the price of corn. The loan was available, however, only to cooperators in the conservation program. These comprised only about 60 percent of the farmers in the commercial corn area. It is estimated that storage operations removed about 9 percent of the 1938 crop from the current year's supply. The loans caused the national average market prices of corn to be about 5 cents a bushel higher than they would have been otherwise, and raised market prices in parts of the western Corn Belt by somewhat more.

Corn-Hog Prospect for 1939–40

It may be useful to say a word as to the probable corn-hog situation for 1939–40. Corn production in 1939 is slightly smaller than in 1938. The carry-over on October 1, 1939, was about 561 million bushels, nearly 200 million bushels greater than the 1938 carry-over. The previous record carry-over was 383 million bushels in 1933. The total production of feed grains—corn, oats, barley, and grain sorghums—will be smaller than in 1938.

But the total supplies of feed grains for the 1939–40 season will be a little larger than the 1938–39 supply, and they will be about 7 percent larger than the predrought (1928–32) average. On the other hand, the total number of hogs and other feed-grain-consuming livestock on January 1, 1940, will be about 7 or 8 percent larger than a year earlier. Hence the supply of feed grains per animal unit in 1939–40 will be about 4 percent less than in 1938–39, though about 8 percent above the 1928–32 average.

Part of the 1939–40 supply will not be available for livestock feeding in that year unless prices rise considerably. The corn that was under loan in 1938–39, some 257 million bushels, will be held by farmers or by the Commodity Credit Corporation. In addition a considerable quantity of 1939 corn probably will be placed under loan. As a result the volume of corn actually available for feeding is expected to be somewhat less in 1939–40 than it was in 1938–39.

The number of slaughtered hogs and pork and lard production in 1940 will be a little larger than in the 5 years 1930–34. Continued hog production at this level may create some difficulties for the producers. Consumer demand in the United States for pork and lard in 1940 will be somewhat better than in 1939 and considerably better than it was in the depression years. Although the war in Europe is expected to result in a material increase in the exports of pork, the foreign outlet may still be restricted. Smaller feed supplies per animal in 1940, and the storage of corn under loan, will check the present tendency for increased hog production.

However, the domestic production of fats and oil that compete with lard has increased in recent years. This has occurred in spite of the fact that the competition from cottonseed oil has been greatly reduced as a result of the lowered production of cotton under the adjustment programs. In 1940 the combined production of lard and competing vegetable oils may be in the neighborhood of 300 million pounds greater than the 1930–34 average, and the export outlet for lard is smaller by about 200 million pounds. The volume of lard produced in 1940 will be large in relation to the probable domestic consumption and the probable export demand. No large increase in lard exports is expected as a result of the war.

THE SUGAR PROGRAM

It was pointed out in last year's report that, despite falling consumer income and general depression in agriculture and industry, the income of domestic sugar producers was fully maintained during the first year of the programs under the Sugar Act of 1937. In the second year (which ended August 31, 1939) during which the act was fully operative some reduction in the income of the industry occurred, under conditions of decreased consumer purchasing power. The industry also continued to feel the effect of the increased domestic sugar production that took place during the years between the Supreme Court's invalidation of crop adjustment in January 1936 and the resumption of crop adjustment under the Sugar Act of 1937.

The quoted wholesale price of refined cane sugar, seaboard basis (net, including excise tax on sugar), averaged $4.40 per hundred pounds for the 12 months ended August 31, 1939, as compared with $4.59 for the first 12 months of the operation of the act. When the conditional payments to growers authorized by the act are included, the total income of the domestic sugar industry for the year was $4.50 per hundred pounds, as compared with $4.69 a year earlier.

Moreover, although the majority of domestic producers received virtually full parity returns on the last crop marketed, consumers paid less for their sugar.

Effect of Program on the Domestic Producers

It is anticipated that when conditional payments, exclusive of those for acreage abandonment or crop deficiency, are included sugar-beet growers will obtain approximately 97 percent of parity per ton of beets for the record 1938 crop which was harvested during the last fiscal year. The total income of these growers is expected to be about $75,000,000, or about $6.52 per ton of beets, for the 1938 crop of 11,614,000 tons, as compared with about $63,000,000, or approximately $7.20 per ton, for the 1937 crop of 8,770,000 tons. Conditional payments included in these totals amounted to $22,000,000 and $17,000,000 for the 1938 and 1937 crops, respectively.

The record Louisiana 1938 crop of 5,859,000 tons of sugarcane brought growers there approximately $3.60 per ton. The total income of these growers from the 1938 crop was $21,000,000, as compared with $20,000,000 from the 1937 crop of 5,258,000 tons. The income from the 1938 crop included about $5,900,000 in benefit payments, or approximately $1 per ton of cane.

The total income of Puerto Rican producers from the 1938–39 crop of 6,875,000 tons of sugarcane was $37,164,000, which represented a drop from the income yielded by the much larger crop of the previous year. The 1938–39 program, under the act, called for the production of a smaller tonnage because of the excess stocks of sugar, totaling about 340,000 tons, which had accumulated in the island after January 1936.

The Hawaiian processor-producers, who grow about 90 percent of the cane produced in the Territory, received from the 1938 crop less favorable returns than in prior years, partly because of lower sugar prices and partly because the crop was deficient in quality.

Acreage abandonment and crop-deficiency payments, a form of free crop insurance authorized by the act, were also made on the 1938 crop to producers who had suffered from drought, insects, or other natural disaster. Such payments on the 1939 crop are expected to be of considerable benefit to beet producers this year because of drought damage in several Western States.

Marketing Allotments and Proportionate Shares

For the first time since the passage of the Sugar Act of 1937 the provisions with respect to marketing allotments and effective proportionate shares became operative in 1939 in all of the domestic sugar-producing areas except Hawaii.

In the mainland cane area, production had increased from an average of 262,000 tons in the years 1928–36, and 383,000 in 1935, the last year of the production-adjustment program under the Jones-Costigan Act, to 462,000 in 1937. In 1938, as a result of the large plantings made in this area in the fall of the previous year, about the time of the passage of the act, production rose to 580,000 tons.

In Puerto Rico there had accumulated between the 1935–36 adjustment program and the enactment of the new act approximately 220,000 tons of carry-over sugar. The domestic beet-sugar-producing area, which because of drought and other causes had for several years failed to fill its quota, followed the short crop of 1937 with the record 1938 crop which yielded 1,803,000 tons.

Virtually every sugar-beet and sugarcane processing company of the United States was represented at the formal public hearings on the 1939 marketing allotments for their areas. Each company naturally supported the allotment formula most favorable to it. One group that did not have so large a proportion of its last crop unmarketed as did most other processors proposed a formula which would give more weight to past marketing history than to production from the last crop. Another group of companies, which on January 1 had more than an average proportion of the last crop unmarketed, argued for a formula which would give dominant weight to either the last crop or the inventory left from that crop.

The act requires, however, that in making marketing allotments consideration is to be given to processings of sugar from beets or cane to which proportionate shares pertained, to past marketings or importations of sugar, or to ability to market or import the quantity allotted. Consequently, the final decision of the Department did not follow the extreme contentions made by these interested parties but endeavored to establish the basis most fair to all concerned.

Marketing allotments have been in effect in Puerto Rico continuously since 1934 because sugar stocks there each year have been in excess of the island's quota.

Processor-Grower Relations

Although the sugar excise tax levied under the act reduces the net proceeds from the sale of sugar which afford the basis of payment by processors for beets or cane, the lower price received by growers from processors is more than made up by the conditional payments. Therefore, the actual effect of the tax-payment phase of the program is to give growers a larger share of the total sugar income than they would otherwise receive. As a further protection to growers, processors who also grow beets or cane are required, in order to qualify for conditional payments, to pay for cane or beets bought from other growers at rates not less than those established by the Secretary.

It has been found that the agreements under which sugar crops (beet or cane) are purchased have much in common. They are of the so-called participating type, i. e., the price of the cane or beets is related to the price at which the semifinished product, raw sugar, or the finished product, direct-consumption sugar, is sold, as well as to the quality of the raw material.

Agricultural Labor

One of the most difficult problems confronting the Department in the administration of the Sugar Act has been the determination

of minimum fair and reasonable wages for agricultural labor, as a condition for Federal payments, in the different producing areas.

For example, in the mainland cane area there are a large number of small growers who employ a few laborers during the course of a season. Side by side with this relatively large number of small farmers are the large plantations, some of them organized on an industrial pattern. A wage finding which would be satisfactory to laborers on the large plantations and to the large planters and semi-industrial group (including the processors who also grow sugarcane) might not be satisfactory to labor employed on the small farms or to the large number of small farmers.

Moreover, a wage that could be borne by the sugar industry, which enjoys the relatively high degree of protection accorded it by the Federal Government, might cause serious difficulties to the neighboring producers of cotton and other farm commodities in the competition for labor. Again, conditions vary greatly in the different areas. Puerto Rico, for instance, is the only domestic sugar-producing area in which wage rates for a considerable part of the agricultural labor employed in the production of sugarcane have for a number of years been determined by written collective agreements between labor organizations and sugar producers. Workers in the island are also protected by social insurance and provisions for double payment for overtime. Hawaiian sugar producers have worked out a system, not found in any other domestic sugar-producing area, which makes it possible for their laborers to work the year round, while the value of the perquisites furnished these workers is relatively high. That conditions vary even within areas is shown by the fact that Florida producers appear to be able to maintain higher wage and labor standards than do most producers in the mainland cane area.

The Department has taken all these factors into consideration in its determinations of minimum wage rates as a condition for payment under the act.

General Problems

The past year has emphasized more than ever one of the difficulties inherent in the sugar-quota system. Inasmuch as the income of both growers and processors is dependent to a substantial degree on the prevailing price of sugar and since rather large stocks of sugar are in the hands of processors, refiners, importers, dealers, and speculators throughout the year, the Department has been subjected to continuous pressure, direct and indirect, to utilize whatever power these interested parties believe it to possess to enhance the value of their stocks of sugar. The Congress, however, with a view to protecting the interests of all groups affected by the act, embodied in it certain standards limiting the discretion of the Secretary in fixing consumer sugar requirements, and it has been the policy of the Department to administer the provisions of the act in accordance with such standards.

Effect of War on Sugar Program

The President on September 11, 1939, in accordance with section 509 of the Sugar Act of 1937, proclaimed suspension of title II of the act, which covers marketing quotas and allotments. This step was made necessary, the statement accompanying the proclamation said, by increased world demand for sugar following the outbreak of the European war, by extraordinary purchases of sugar by consumers, and by apparent speculative activity. The President's action made immediately available to consumers a reserve supply of about 800,000 tons of domestic sugar.

In a statement accompanying his proclamation, the President informed domestic producers that they would continue to receive payments under the 1939 conditional-payment program. He stated, however, that as long as quotas were continued in suspension growers were not to assume that payments could be made with respect to future crops. He also pointed out that growers should not assume that increased acreage planted under the stimulus of war conditions could be made permanent for purposes of determining future allotments.

DAIRY ADJUSTMENT AND THE NATIONAL FARM PROGRAM

The operations of the dairy industry, which had been somewhat curtailed by the droughts and feed shortages of 1934 and 1936, have resumed their upward trend. The number of milk cows on farms at the beginning of 1939 was 1 percent larger than a year earlier—the first increase in 5 years. Over a long period dairying has been gradually expanding in line with the increase in population.

The income of milk producers, however, has dropped off considerably in the last 2 years; and since dairying accounts for about one-fifth of the total agricultural income of the country, the seriousness of any marked slump in this industry is apparent. For some years prior to 1930 the gross income to farmers from dairy products averaged about $2,000,000,000 a year. In 1932 it dropped to $1,250,000,000. By 1937 the dairymen's income had returned to $1,961,000,000, but in 1938 it again dropped off about $200,000,000 and in 1939 there was a further decline of about $150,000,000.

This slump in the last 2 years has tended to put the dairy situation among those problems which press for some kind of solution within the general agricultural program. But milk products differ in important respects from the major crops with which the general program has been called upon to deal.

The dairy industry is very stable as to production; yet it does not escape these rather wide fluctuations in prices and income. Its stability of production has been well shown in the last 15 years during which, notwithstanding two of the worst droughts in history and a serious depression among urban consumers, its per capita production of milk products has varied within a range of only 6 percent. Its prices, on the other hand, have fluctuated quite violently, along with

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those of many other commodities. From 1929 to 1932 prices paid to dairy producers declined 47 percent, while the per capita production of milk increased only 2 percent. From 1933 to 1937 prices paid to dairy farmers rose about 50 percent. Then during 1938 and 1939 about one-half this gain was lost. Thus, the year-to-year income of dairymen has swung up and down with these sharp changes in prices. Yet this is a case where the fluctuation cannot be ascribed to like changes in production.

Dairying is a domestic industry. Both imports and exports of dairy products are very small relative to our own production. With our protective tariff on dairy products and prices here maintained quite commonly above the world level there is little opportunity for developing profitable export outlets except in a small way in tropical Latin America.

In short, the problem of helping the prices of dairy products cannot be approached in the same way as we approach that of the great export products, wheat, cotton, tobacco, pork, and lard. Curtailing the output of dairy products, for example, would mean simply a smaller supply for domestic consumers. In the face of this fact, plans for restricting milk production have so far not been viewed as desirable or feasible except as a last resort in meeting an acute situation.

Some dairy leaders have contended that they get little benefit from the agricultural program, their position being that the soil-conservation program stimulates the production of hay, pasture, and forage crops, an abundance of which is likely to induce the raising of dairy and other cattle to eat it. At the same time they feel that the price-raising effects of the program on corn, wheat, and concentrated feedstuffs add to the production cost of large numbers of dairymen who normally buy such feed. The Department has given this point of view the most careful consideration throughout and will continue to do so. There is no intention to help one line of agriculture at the expense of another.

Main Farm Program Aids Dairying

There is, however, another side to this argument. Prices of cotton, wheat, tobacco, and hogs would drop to extremely low levels if they were allowed to go as low as the present-day restricted foreign outlet would put them. Low prices for these products almost inevitably would mean a considerable shift on the part of such growers into dairying. That has happened before, to a degree, and could become a very widespread movement. It can be said that the agricultural program undoubtedly is staving off a large element of added competition which dairymen otherwise would face under present conditions.

The purchase of dairy products by governmental agencies in time of excess supplies and falling prices has been developed as one effective approach to the dairy-price problem. Studies of food consumption among families of low income show consistently that these families do not eat the quantity of dairy products that they should have, according to only moderate dietary standards. The surplus-

purchase plan accomplishes the double result of aiding a domestic industry by moving its products into wider consumption while our own needy people benefit by getting more of a valuable food.

Aid also has been rendered to the producers of fluid milk through the marketing agreements under which milk moves to some of the large retail markets. These marketing agreements—in which the State and Federal Governments assume somewhat the role of umpire and enforcement officer—have helped materially to stabilize the flow of milk to metropolitan centers and to prevent serious break-down in prices.

As to the outlook for the dairy industry, one central item to be noted is the increase now going forward in the number of milk cows and more especially in heifers and calves. The number of young stock now on farms is more than enough to provide for normal replacements in the next couple of years. In other words, the stage is set for moderate increases in milk production. This means apparently that consumption must improve also if further ill effects on the price structure are to be avoided.

The consumption of fluid milk and cream declined along with the slump in business which occurred in 1937. Considerable milk was diverted into butter and other manufactured products—enough so that the output of manufactured dairy products in 1938 was the highest per capita in 40 years. In 1939 milk production continued at a high level but consumption of fluid milk improved somewhat and somewhat less of it was made into other products. The prospect is that production will be on a high enough plane in the next year or two so that developments on the demand side must be very favorable or we shall have to deal with a still more difficult dairy problem.

DAIRY BREEDING TESTS AND RECORDS

Thousands of dairy farmers could reduce their costs of milk production and make a more satisfactory profit it they would adopt a scientific breeding program to improve the milk-producing efficiency of their herds.

As a result of many surveys of the production and income records of herds in dairy herd-improvement associations, the Bureau of Dairy Industry concludes that nearly two-thirds of the heifer calves saved for replacement purposes throughout the United States fail to be profitable milk producers. Raising three heifers to the age when the owner can determine which two to cull from the herd adds tremendously to the cost of producing milk in many herds. Since two thirds of the heifer calves born every year are predestined by their inheritance to be unprofitable, the big problem in improving the Nation's dairy cattle is to eliminate the hereditary factors responsible for the low-producing females.

The Bureau of Dairy Industry has now completed 21 years of breeding investigations, and the results indicate that the most promising method of improving the inheritance of a dairy herd is through the use of an unbroken succession of proved sires—that is, sires that

are known to have the ability to transmit high levels of production uniformly to all their daughters.

In its experimental herds at Beltsville, Md., the Bureau has used the proved-sire system of breeding with excellent results. In a Jersey herd, the foundation cows selected to start the experiment 21 years ago had an average production of 11,626 pounds of milk and 624 pounds of butterfat. Eight proved sires have been used in this herd since it was founded. Today the herd is made up of the unselected female descendants of these proved sires and the foundation cows.

The 33 females that are old enough to have production records average 13,632 pounds of milk and 710 pounds of butterfat (mature-equivalent basis). This increase of 2,006 pounds of milk and 86 pounds of butterfat per cow was brought about entirely through breeding; that is, without the benefit of culling or of improving the feeding and management conditions throughout the 21 years.

In a Holstein-Friesian herd at Beltsville, the foundation cows had an average production of 19,966 pounds of milk and 678 pounds of butterfat. Five proved sires have been used in this herd. Today the herd is made up of 36 unselected female descendants (outbred and line-bred) of the foundation cows and these 5 proved sires. These daughters average 20,305 pounds of milk and 773 pounds of butterfat, an increase of 339 pounds of milk and 95 pounds of butterfat, that can be attributed entirely to the breeding program.

In these experimental herds, where only sires of proved merit have been used, few low-producing females have appeared among the offspring and their number has gradually diminished with each succeeding generation of proved-sire matings. Furthermore, on the average, the young bulls born in these herds carry the same desirable genetic make-up as the heifers, and they have proved to be uniformly good as sires in the farm herds where they have been loaned for proving.

Of 28 Beltsville-bred Jersey bulls, only 4 failed to increase production in the farm herds; of 32 Holstein-Friesian bulls, only 5 failed to increase production; whereas less than half the bulls used and proved in dairy herd-improvement association herds have increased production. This part of the experimental work is convincing evidence that young untried bulls from herds where good, proved sires have been used continuously are more dependable than untried bulls from herds of unknown inheritance.

Speeding Dairy Herd Improvement

Good proved sires are scarce and, as a rule, they have only a few years of active usefulness after they are old enough to be proved. To speed up the improvement of the Nation's dairy cattle, therefore, it is imperative to locate as many outstanding sires as possible and to make the fullest use of them and their sons. Testing all the daughters of a sire and comparing their production records with those of their dams is the only way to locate desirable sires or to gain sufficient information to develop such sires.

For 3 years now the Bureau of Dairy Industry, in cooperation with the State extension dairymen and the members of dairy herd-improvement associations, has been conducting a record-keeping program to help dairymen find desirable germ plasm for improving their herds. In this program, the association testers make an effort to report the identity of every animal enrolled in the association herds, and the Bureau is keeping a permanent file of all animals reported. Along with these identification records, the production records of the females are filed as fast as they are made and reported. This enables the Bureau to tabulate the proved-sire record, or breeding performance, of every listed bull as soon as he has five dam-and-daughter production records in the files. It makes no difference where the daughters of a bull or their dams are located when they make their records; they may be in the same herd or in different herds in different States.

There are now 509,078 females and 91,856 bulls listed in the Bureau's permanent files. They represent registered as well as non-registered purebred and grade animals. Of these females, 236,098 in 14,718 herds have made 1 or more production records; and proved-sire information is accumulating on 40,708 sires. To date the Bureau has tabulated the proved-sire records of more than 4,000 association sires with 5 or more daughters.

The Nation-wide character of the identification and permanent-record program makes it possible to follow the progeny of any outstanding animal, family, or strain down through all succeeding generations as long as they remain in the association herds and their records are reported for filing. Members of herd-improvement associations eventually will thus have the necessary information to analyze the progress they are making toward fixing an inheritance for high production in their herds and also to select the families or individuals that show the most promise as breeding stock.

The young bulls from these herds that carry several generations of good proved-sire breeding may be expected to become an important factor in improving the thousands of average farm herds in which no effort is made to keep production records or follow a scientific breeding program.

FRUITS AND VEGETABLES

Combined production of all fruits from the bloom of 1939 will be slightly larger than in 1938, and almost one-fifth larger than the recent 10-year average. On the other hand, the total output of vegetables including potatoes, truck crops for market and processing, and dry edible beans will be somewhat smaller than a year earlier.

As compared with supplies in 1938, larger crops of apricots, apples, cherries, plums and fresh prunes, peaches, and strawberries more than offset smaller crops of citrus, pears, grapes, prunes for drying, and olives. Supplies of summer oranges from the bloom of 1938 were also smaller than a year earlier. With the exception of grape products, which were exceptionally large, carry-over supplies of most canned and dried fruits were smaller than the relatively large stocks carried

over in 1938. Most of these fruit crops will be available for market in the last half of 1939 and in the first half of 1940.

Because of increased production of fruits generally in Europe this season and the interruptions to shipping occasioned by war conditions, the export outlook for most fruits and fruit products in the 1939–40 season is unfavorable. It is probable that exports of fresh apples and pears and dried fruits will be curtailed somewhat from the relatively high levels reached in 1938–39. This situation is likely to result in greater than usual supplies being available for the domestic market.

In the first half of 1939 there were sharp increases in marketings of citrus fruits but smaller supplies of apples than in the first half of 1938. Improved demand caused prices of fruit crops generally in the first half of 1939 to average somewhat higher than during the first half of 1938. In the second half of 1939, increased production has more than counterbalanced the improvement in demand.

From the standpoint of cash income to producers, however, 1939 as a whole will be a better year than 1938. The quantity of all fruits available for market has little effect on the total cash return; the important factor is the level of demand. In 1939 the level of demand was slightly higher than in 1938. Cash income from fruit production is likely to be about 7 percent greater than in 1938 but about 22 percent less than the high level reached in 1937. In that year the cash income from fruits was $546,000,000, or just about double that of 1932.

Despite slightly increased plantings, production of potatoes and truck crops for fresh market shipment in 1939 will be slightly smaller than in 1938. Sweetpotato production, however, is slightly larger. Sharply reduced acreages and smaller yields per acre made the production of truck crops for canning or manufacture smaller than in 1938. Production of dry edible beans, for similar reasons, was also lower than a year earlier.

Cash income from marketings of potatoes and vegetables in 1939 probably will be about 8 percent greater than in 1938 but about 12 percent smaller than the relatively high level reached in 1937.

FEDERAL ROLE IN FARM CREDIT

The Federal Government has come to occupy a position of considerable responsibility for the proper functioning of the agricultural credit system. The Federal land banks and the land bank Commissioner now hold about 40 percent of the farm-mortgage debt; they also own many farms acquired from defaulting borrowers. Other federally sponsored agencies that have loaned principally on personal and collateral security also hold a large volume of agricultural loans. There is a double task involved. Not only must Federal credit agencies manage loans and farm real estate soundly from a financial standpoint, but they must conduct their operations in conformity with the interests of agriculture as a whole.

Even with loans involving no greater risks than are normally assumed by private lenders, the federally sponsored lending agencies have been expected to exercise exceptional care in suiting the terms and conditions of payment to farmers' needs and also to implement

general public policy with regard to farm ownership, farmer cooperation, and amelioration of farm-debt problems. Most of the loans have been of this type. Many, however, have necessarily involved somewhat greater than normal risks, since they have been made as an integral part of the agricultural relief and stabilization programs. If for no other reason than to protect the general public against loss, such loans should be administered so as to help correct the basic maladjustments that gave rise to them.

Main elements of the national agricultural-credit program have been developed gradually. Following agitation for better rural credit, Congress provided in 1916 for the Federal land-bank system and for the joint-stock land banks. In 1923 it established the intermediate-credit banks. In addition, Congress acted at different times to meet special emergencies; for example, it made feed and seed loans available in 1918 and later years, and assisted private financial institutions through the War Finance Corporation following the collapse of prices in 1920. The loans to meet special emergencies, though relatively small in total volume, had much in common with the loans of more recent years.

The increased importance of the Federal Government in farm finance has appeared not only in an expansion of Federal lending but also in a change in the character of the Federal credit operations. Formerly, except in the loans for special emergencies, the Government confined its efforts primarily to the sponsorship of specialized mortgage and intermediate-credit agencies in such a way as to facilitate the flow of private credit to farmers. Actual public lending was minor. After 1929, however, private credit agencies could not fully meet the requirements. On the one hand the nature of the financing required by farmers at this time involved heavy risks; and on the other hand private funds for mortgage financing and for intermediate credit were not available in sufficient quantity. The situation required the extensive use of public credit and congressional appropriations.

In the depression of the early 1920's there was comparatively little difficulty among financial institutions except in agricultural sections. Life insurance companies as well as the Federal and joint-stock land banks were well able in that period to assist farmers and to relieve country banks and other local lenders by refinancing operations. Financial conditions were very different in the much longer and severer depression that followed in 1929. That depression produced acute difficulties among financial institutions in all parts of the country. It resulted finally in a general financial collapse. In consequence the Federal Government had to recapitalize the land banks and to provide extensive additional farm-credit facilities.

Simultaneously, moreover, the Government had to launch a comprehensive program of agricultural adjustment and farm rehabilitation. Farm-commodity prices were abysmally low; farm surpluses were of towering proportions. There was widespread farm distress. A comprehensive program of crop adjustment and farm relief was necessary. In the field of finance it was necessary not only to strengthen the existing farm-credit facilities but to provide additional facilities for farm

rehabilitation and other special needs. There was need also for lower interest rates, for debt adjustments, for the extension of payment dates, and for stabilization loans on stored commodities. These operations required the Government to assume financial risks beyond those that private institutions could be expected to carry.

Main Requirements in Credit Policy

The important position now occupied by federally sponsored agencies, though due in part to the favorable terms offered, has resulted mainly from the break-down of private financing during the depression and from a broader concept of public responsibility for agricultural adjustment and rehabilitation. For the future it is important to formulate policies for the administration of loans that will reduce the risks in agriculture and the dependence of farmers on governmental aids and grants. It seems not too much to expect that through joint efforts made by federally sponsored and private credit agencies long-run policies in agricultural finance can be developed which will prove of lasting benefit to agriculture and the Nation and be a source of protection to individual farmers and private lending agencies.

In broad outline the general requirements as to such policies are clear. They involve the readjustment of farm debt to levels consistent with farm incomes disposing of acquired real estate on terms that will make for profitable ownership by the purchasers; and the formulation of lending standards that will discourage excessive price fluctuations and encourage proper land use methods. With regard to these fundamentals there is little controversy, though the details of credit policy may often be matters of disagreement.

There is room for a considerable expansion of debt-adjustment activities. In recent years such activities on the part of the Farm Credit Administration and the Farm Security Administration have proved advantageous both to debt-burdened farmers and to creditors who wished to realize upon their farm loans. Particularly in areas of low and uncertain income, an immediate recognition of losses and an equitable readjustment of debts will encourage necessary crop shifts and other farm adjustments. In many localities reappraisal of debt-paying possibilities is a main requirement.

Disposal of Acquired Realty

Policies adopted for disposing of acquired farm real estate should be designed to prevent the recurrence of farm-debt difficulties. Land unsuited to profitable farming should not be sold for agricultural purposes; with other farms, preference should be given to buyers who are able, and have sufficient capital, to adapt the land to its most economic use. Moreover, the sale of farms on small down payments may burden farmers with unmanageable fixed charges unless provision is made for lower payments in periods of poor crops or low prices. The danger is especially great if the farms have widely fluctuating earning capacity or have deteriorated to such an extent that their restoration will require heavy expenditures out of current earnings. Some lending agencies rehabilitate their farms prior to

sale and encourage farming practices designed to maintain earning capacity. This policy can be carried still further in the interest of both lenders and farm purchasers.

The concept of normal value employed by the Farm Credit Administration since 1933 has permitted the refinancing of many farmers who, under the more common practice of lending according to market value, probably would have lost their farms through foreclosure. It would be equally feasible to employ the normal-value concept in times of rising prices and land values. This would curb those credit extensions which result in the creation of permanently high debts on the basis of only temporarily high incomes.

Lending agencies can encourage the use of credit for purposes that will conserve the farm plant and discourage those uses of credit that contribute to overcropping and soil deterioration. There is a wide field, in short, for the promotion of farm and national welfare through the judicious use of agricultural credit.

SHORTCOMINGS IN FARM-TAX METHODS

Farm taxes and local government have important effects on the economic position of farmers, and various studies show that in many places social and cultural advantages and aids to production could be provided at much less than the present cost. Frequently, however, local governments do not have the necessary fiscal and social vision or the necessary efficiency of organization and administration. Many communities, moreover, lack the resources and the diversity of economic life that are necessary to create stable revenue units. Not only is there undue reliance on the general-property tax, which in most rural localities is virtually a real-estate tax, but types of real-estate use do not vary in a sufficiently broad way to assure the necessary stability of revenue from property taxes.

This of course is an old story, but its importance does not diminish. The general-property tax is the largest tax that farmers pay. Properly, according to accepted economic principles, a tax on land values should fall on net rent. The farmers should be able to pay it out of the income that accrues to the land as its share in the farm returns. In practice the farm real-estate tax varies greatly from such a purely land tax. (1) In addition to the permanent element of the land, the tax covers improvements and also perishable land elements that require upkeep. (2) It is haphazard; assessment is often nearly a blind guess at the value. (3) It is regressive; in other words, blind guessing at the value tends to overrate land of low values and to underrate high values. (4) It varies greatly in the 48 independent State systems, which include more than 160,000 semi-independent local jurisdictions.

Burden Heavy and Increasing

Next to the real-estate tax in importance to agriculture is a group of taxes that apply to automobiles and motor fuels. These levies, which comprise property, sales, title, and license taxes on farm automobiles and parts, and also sales taxes on gasoline, amounted in

1937 to about 40 percent as much as the farm real-estate tax. Naturally, the cost of automobile and gasoline taxes falls alike on the farmer's business use and on the personal use of his automobile. The part chargeable to the business use adds to the cost of farm production; the part chargeable to the personal use cuts into the farmer's available income for other expenditures. Taken together the real-estate taxes and the automobile and gasoline taxes constitute a heavy and an increasing farm burden.

Taxes on farm real estate were much lighter before the war than they are now, and there were then no important automobile or gasoline taxes. Farm-property taxes in the period 1900 to 1920 increased approximately as fast as did general prices and wages. The receipts were sufficient to supply a constant amount of local government services. By 1920 farm real-estate-tax levies per acre had risen to 244 percent of the average pre-war (1909–13) levy. Farm real-estate taxes continued to rise from 1920 to 1929, though in that period general prices, farm values, and farm income all declined. In the same period, moreover, the States became increasingly conscious of the revenue possibilities in automobiles and gasoline, and an almost continuous increase took place in the rates and receipts of these taxes.

All told, the real-estate, automobile, and gasoline taxes paid by farmers increased more than 50 percent from 1920 to 1929. Increasing delinquency of rural real-estate taxes late in the decade of the 1920's was a clear indication that taxes had become an extremely burdensome element in farmers' costs. After 1929 farm taxes decreased, following declines in farm prices and farm incomes. They dropped about 36 percent, or to a point below the level of 1919. In relation to the farm real-estate value, however, the tax burden continued to rise until 1932. One result was a tripling of tax delinquency between 1928 and 1932. In some individual years in this period the delinquency involved a quarter of the total property taxes levied against rural real estate. Though much of the delinquency was temporary, much was chronic or permanent.

Cessation of tax payments permanently on any piece of land indicates that the property has collapsed economically. The final overloading may result in different areas from different causes. It is very significant, however (and shows the regressive application of the real-estate tax), that the collapse in most cases involves the poor farms. This indicates the virtual universality of disproportionate tax burdens and of greater likelihood of tax delinquency on low-yielding lands.

Recent Tax Trend

Since 1934 farm real-estate taxes per acre have risen at about the same rate as they did in the decade of the 1920's. Automobile and gasoline taxes also have risen appreciably. Moreover, general-sales taxes have built up an annual bill of more than $25,000,000 against farmers. There is urgent need for a redistribution of the farm-tax burden. It should be redistributed, not only among different parcels of land more nearly in harmony with their relative earning power,

but as between agriculture and other sources of public revenue. Considering the extent of intangible values and nonproperty incomes, the persistent overemphasis on farm real estate as a source of revenue is an obvious injustice.

Various measures can relieve the difficulty. Land that is hopelessly tax delinquent has lost all value in its present use and organization. It should be turned to other uses through efficient land use planning. In this field the land use programs of the Federal Government are obviously of great value. Farm-rehabilitation programs in tax-burdened areas serve to improve the relationship between tax levies and farm-earning power. Much can be done to eliminate sporadic, uneconomic production on lands not suited to farming. Differential taxes may encourage wise and discourage unwise land use practices. Reorganization of land uses in accordance with a long-time program will emphasize the need of tax revision, but will often enable local governments to reorganize their services on a more economical basis.

It should be borne in mind, however, that such measures do not entirely cover the ground. They give no full assurance, for example, that unbalanced State and local tax systems, coupled with the regressive or unfair application of farm real-estate taxes, will not continue to overburden and finally to incapacitate farm lands. Even lands that can properly be kept in cultivation can be brought to economic distress in this way. The whole question needs to be gone over thoroughly and comprehensively. There is urgent need for general State tax revision and for improved tax administration.

CIVILIAN CONSERVATION CORPS ACTIVITIES

This Department has had a large share in the emergency conservation work since its beginning in 1933. More than two-thirds of the Civilian Conservation Corps camps have been allocated to the Department for its conservation programs. Established originally as an independent agency, the Civilian Conservation Corps on July 1 last became a unit of the Federal Security Administration. It operates in connection with, and under the technical supervision of, the War Department, the Department of the Interior, the Department of Agriculture, the Department of Labor, the Veterans' Administration, and State conservation agencies.

Main activities of the camps assigned to the Department of Agriculture are the improvement, development, and care of soil, forest, wildlife, and recreational resources. Among the specific tasks are the protection of these resources from forest fires, insects, fungus diseases, and destructive weather conditions. Forestry and soil-conservation work by Civilian Conservation Corps camps under the Tennessee Valley Authority are supervised by this Department through its Forest Service, as are likewise Civilian Conservation Corps conservation work on State and privately owned forest lands. In Alaska and Puerto Rico the Forest Service supervises the Civilian Conservation Corps field work and also the Civilian Conservation

Corps camps. In the continental United States the War Department manages the camps.

The Director of the Civilian Conservation Corps is assisted and advised by a council made up of a representative from each of the following agencies: The War Department, the Department of the Interior, the Department of Agriculture, the Department of Labor, and the Veterans' Administration. The Department of the Interior and the Department of Agriculture are the chief so-called using departments. They plan and supervise the work projects. However, for several years the War Department had camps on military reservations and on certain flood-control projects under the Corps of Engineers. The Navy Department also formerly had a few Civilian Conservation Corps camps. Generally, the Department of Labor handles the selection of youths for enrollment. The War Department builds and administers the camps, and houses, clothes, feeds, and pays the enrollees, and looks after their morale, discipline, health, and education. These diverse functions and responsibilities call for an exceptional degree of cooperation and coordination, and the success of the Civilian Conservation Corps is evidence that the requirement has been fulfilled.

Within the Department of Agriculture the program has involved the cooperation of many bureaus, such as the Forest Service, the Soil Conservation Service, the Bureau of Agricultural Chemistry and Engineering, the Bureau of Plant Industry, the Bureau of Animal Industry, the Bureau of Entomology and Plant Quarantine, and the Agricultural Research Center at Beltsville, Md. The Department's representative on the Civilian Conservation Corps council has general Department-wide responsibility for the administration of the Civilian Conservation Corps programs carried on by the bureaus.

Office of Civilian Conservation Corps Activities Established

In 1938 the Secretary established within the Department the Office of Civilian Conservation Corps Activities with a chief and a small staff. It is the task of the Chief of the Office of Civilian Conservation Corps Activities to coordinate all these activities into a unified program and also to coordinate Civilian Conservation Corps activities with other programs of the Department. This Office has general oversight over Civilian Conservation Corps matters pertaining to finance, budget, equipment, personnel, and location of camps. The several bureaus prepare work specifications for Civilian Conservation Corps use, make applications for new camps or shifts in the location of existing camps, draw up work plans, and estimate the requirements in terms of labor and materials. Their proposals and requests must be coordinated with similar applications in the other departments. This is the responsibility of the Civilian Conservation Corps Director and the council.

Selection of enrollees is the task of State selection boards under the supervision of the Director of the Office of Civilian Conservation Corps Activities. Actual administration of the camps is a War Department function. Planning and supervision of work by the

enrollees is a responsibility of certain agencies in the Departments of Agriculture and the Interior.

Practically, the youths in the camps assigned to the Department of Agriculture become a part of the Department's labor force during 8 hours each day for 5 days each week. They work under project superintendents, technicians, and foremen selected by the Department's bureaus. In May 1939 there were some 10,000 Civilian Conservation Corps field-supervisory, technical, and facilitating personnel under the Department's supervision. Though paid from Civilian Conservation Corps appropriations, the supervisory and facilitating personnel are under the rules and regulations of the Department as long as they are a part of the camps assigned to the bureaus.

In the fiscal year 1939 the number of Civilian Conservation Corps camps assigned to the Department averaged 1,059. There were some of these camps in all the States. In addition, the Department supervised Civilian Conservation Corps work in the District of Columbia, Alaska, and Puerto Rico. The Department had charge of a wide variety of conservation projects in many locations; for example, on National, State, and privately owned forests; on soil-conservation projects; in wildlife, migratory-bird, and big-game refuges; in organized drainage districts; in national arboretums; and in the Tennessee Valley area.

Some Civilian Conservation Corps Accomplishments

Accomplishments of the Civilian Conservation Corps on projects of the Department since 1933 have been extensive and to a high degree permanent. Many of the Department's bureaus had drawn up long-range conservation plans long before 1933, but lack of funds and labor had prevented them from being put in operation. The Civilian Conservation Corps has made funds and labor available, and hence has brought to fruition much conservation and other field work that otherwise would have remained undone indefinitely. Some authorities believe the Civilian Conservation Corps has advanced conservation by a quarter of a century. Tree planting, soil saving, protection from forest fires, and protection from insects and fungi have put millions of acres in shape to become productive again. Other millions of submarginal or waste lands have been improved and converted into suitable habitats for wildlife. Hundreds of campgrounds and recreation spots have been developed for public use, and hundreds of thousands of acres of farm lands have been drained and made productive. All this work has been done on plans and specifications prepared by experienced technicians.

Along with the improvement and betterment of natural resources have gone the betterment and often the salvation of Civilian Conservation Corps enrollees. Approximately 1,500,000 young men have worked in Civilian Conservation Corps camps under the Department of Agriculture in the last 6½ years. Formerly undernourished, anemic, discouraged, and listless, these boys have gained in physical, moral, and mental stamina through regular and daily work. It has not been "made work," but work which the boys have come to recog-

nize as a permanent contribution to the national welfare. As they have learned how to work, they have enjoyed the pride of accomplishment. Technicians and foremen have taught them how to use tools and machines and how to work efficiently. Many of the boys have acquired in the camps their first conception of a real day's work. Job training, from the beginning an integral part of the Civilian Conservation Corps activities, has paid rich dividends in human development. On leaving the camps at the end of their 2-year periods, graduate enrollees have faced the world with confidence and energy, and with invaluable vocational training.

PERSONNEL

The effective performance of functions assigned to the Department of Agriculture requires a well-planned and diversified personnel program.

The personnel program is adapted to a wide variety of organizational, functional, and working situations. The Office of Personnel handles all matters of policy and procedure for the entire organization. Bureau personnel officers assume a large measure of responsibility for administering the program within their respective units. The fundamental objective is to increase operating efficiency at all levels by maintaining a working environment that will motivate the highest level of performance.

With this objective in mind, the Department is developing a well-rounded personnel program. In its early stages the work was limited to maintaining employee records and to the regulatory phases of operation such as appointments, classification, and investigations. These are still essential personnel functions. During the past fiscal year 108,748 personnel actions were processed and 43,564 recommendations were reviewed for accuracy of classification. With the expansion of the Department and the increased emphasis on personnel administration, however, the program has broadened.

Important aspects of it now include in-service training; improvement of personnel relations; promotion of employee safety, health, and welfare; encouragement of career service for competent employees; and general development of greater incentives and better morale. Particular emphasis is given to the problems of raising qualification standards, providing better training facilities, and developing career opportunities. In addition, a specialized service in the field of organization and management is made available to the Department agencies. This will provide assistance in reviewing internal problems of management and will tend toward a greater coordination of the functions and personnel relations of the various units that comprise the Department.

The Department is attacking the problem of raising the general level of employee competence. More exacting qualification standards are being developed for many positions. All recommendations for appointment or change in status are reviewed for adequacy of qualifications. During the last fiscal year, 40,383 such recommendations were reviewed. In addition, personnel officials cooperated closely

with the Civil Service Commission in establishing proper minimum qualification requirements for entrance to examinations for positions peculiar to the Department.

The importance of employee training has long been recognized both in private industry and among administrative officials of this Department and other governmental agencies. Training activities in the Department help new employees to gain an early understanding of the geography, organization, and functions of the institution, increase employee efficiency, and prepare employees for advancement. The Executive orders of June 24, 1938, gave new impetus to the development of adequate training facilities. A committee on in-service training has been appointed to study training programs and policies. It has made recommendations that lay a strong foundation for a long-time Department-wide training program. A recent count revealed approximately 300 training projects in operation, in addition to educational programs.

The incentive provided by the prospects of a life career with reasonably rapid advancement enables the Department to attract and hold good personnel. Vacancies are filled whenever possible by promotion from within. Facilities have been set up that make it possible to record the qualifications and experience of all employees and to locate quickly those individuals in the Department who are qualified to fill a specific job. During 1939, 10,097 vacancies were filled by promotion from within the various bureaus and offices; 3,475 were filled by interbureau transfer. Facilities have been improved for the expeditious handling of complaints and maladjustments. The objective is just treatment of employees at all times. The results are an improvement in the mental attitude of employees, increased employee confidence in the Department's management, and a general increase in employee efficiency.

Fact-finding and research are important in personnel administration. Scientific study of personnel data yields results valuable in determining policy and procedure. A continual flow of information and assistance is provided to responsible officials throughout the organization. Personnel management is deeply interwoven in every phase of the Deparement's operation. Supervisors at all administrative levels have personnel-management functions. They occupy the key positions through which the personnel program is applied in daily contacts with employees.

THE EXTENSION SERVICES

With the war in Europe already affecting American agriculture to some extent, cooperative county extension agents near the end of the year redoubled their efforts to place the facts about supplies and prospects of farm commodities clearly before farm people in every community.

The annual outlook report, issued by the Department late during the fall, was localized by State cooperative extension services and explained to farm people in terms of their local problems by county extension agents in community farm-outlook meetings. The agents

also used local radio stations and newspapers, personal visits and office calls, circular letters direct to farm people, and charts, film strips, and other material to give farmers an understanding of the facts. They urged farmers to base their plans for the coming year on soundly considered prospects rather than on possibly unfounded hopes for rapid market expansion.

In cooperation with locally elected agricultural conservation committeemen, the agents intensified their efforts to explain the 1940 agricultural-conservation and crop-adjustment program and to urge farmers to hold the conservation and balanced-farming gains they have made in recent years.

One of the major activities of extension agents during the year was the organization and leadership of county planning committees composed largely of farm people. Organization of these committees proceeded in practically every county in the country, in line with the Mount Weather agreement of 1938. Intensive land use planning on a wide scale was under way in 830 counties at the end of the year. Extension agents, besides being active in the organization of these committees, served as secretaries and key advisers of the committees.

The significance of this movement appeared in the wide interest and participation it evoked. Farmers showed an evident liking for land use planning. "White soil," as one community calls it, will not grow good crops, and information about desirable rotations and other good farming practices was in eager demand. Other topics much discussed at the community meetings were the problems of the young people: the needs of farm homes: the coming of rural electrification; the need for home gardens and dairies: roadside beautification: and health facilities. Vital matters that cannot be set down in land use maps found expression nevertheless in the emerging community programs.

County extension agents report that the community committees welcomed facts about the farm outlook, terracing practices, crop rotations, proven erosion-control practices, and better methods of building homes and preserving food. Members, without being themselves experts, found themselves fully capable of combining technical data with their local knowledge and experience.

For example, the Ross County, Ohio, land use planning committee classified the soils of that county into A, B, C, D, E, and F classes and prepared a map showing these areas and their recommended use. The committee recommended that virtually all class-D land be converted to woodland: that the less broken land in class C, where accessible to livestock-producing areas, should be developed as permanent pasture: that the remaining class-C land should be retired or reforested: and that all land in the county now in woodland pasture should be devoted solely to growing timber.

Many other examples could be cited. Other committees recommended that certain areas of good uncultivated land be brought into cultivation: that the size of farms in some areas should be increased: that tenants should be given better leases: and that some of them should be helped to find better farms.

Unified County Programs

The State land use planning committee, composed of farm people and representatives from all land use agencies in the State, with the State extension director as chairman, coordinates the county plans and passes them on to the Department in Washington. In at least one county in every State unified programs based on the recommendations of the local planning committees are under way, which aim at adapting the programs of all agencies to carry out the recommendations of the local planning committees. Organizing and helping farm people in such coordinated county planning has developed as one of the major jobs of cooperative extension agents.

More than a million organized farm women, working under the leadership of home demonstration agents, are seeing in county planning a chance to realize some of their ambitions. They are looking at the problems of the community from the standpoint of the farm home and the family and are working toward better living as well as toward better agriculture. The women's part is vital in the development of county planning goals.

More than a million and a quarter 4-H Club members likewise contributed to the development of the county plans. Their activities had to do with educational, social, and recreational opportunities, with proving the value of legumes, with learning to lay terrace lines, with the introduction of the dairy cow into the family living scheme, with better food preparation, with better health, and with other important aspects of the farm, the home, and the community. Extension agents during the year continued to reach 40 percent of the rural youth of the United States through 4-H Clubs.

There are county agricultural agents in every county of agricultural importance, and county home demonstration agents in nearly two-thirds of the counties. In addition, 1,169 assistant county and home demonstration agents help to carry the load.

The county agricultural agents have had an average of 8 years of experience in extension work and 6 years in the county in which they now are. The home demonstration agents have been in extension work an average of 5 years and in their present counties an average of 4 years. About 1,500 State extension specialists help the agents to keep abreast of technical developments and to adapt them to local needs. The county agents give advice and information to large numbers of Negro farm families. In 256 counties special Negro agents are employed.

More than half a million voluntary local leaders, selected and trained for their jobs by the county agents, help to extend improved farming and homemaking practices and 4-H Club work to almost every community. These local leaders play a vital part in promoting the discussion of economic and social problems and interpreting local conditions and local thought to planning groups. They are an important link in the development of an agricultural program through the democratic process.

This organization, with a few supervisors, makes up the cooperative extension organization of the Federal Department, the land-grant

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colleges, and the county governments. It is the growth of 25 years. The total appropriation for all cooperative extension work is $32,000,000. About $18,000,000 of the amount comes from Federal grants to the States through this Department, about $6,500,000 from State funds, about $6,500,000 from county appropriations, and about $890,000 from farm organizations.

Some Types of Extension Work

If farm people are to make progress in sound land use planning, crop adjustment, soil conservation, and improved tenure, they must have the latest scientific information about efficient production and marketing of crops and livestock. Also they must have information on social and economic trends and information about agencies that can be utilized in carrying out their plans. Extension agents during the year organized 1 million adult result demonstrations on farms and in farm homes, and 1¼ million group meetings. They made 3 million visits to farm homes and received many office calls from farm people. In these and other ways they disseminated technical information and helped farmers to consider it in relation to the other factors of rural living. Aided by 14,000 voluntary leaders, they gave assistance in marketing work in some 18,500 communities.

Approximately 1,200,000 farmers, either as individuals or as members of cooperative groups, took advantage of this help. The agents helped farm people to fight hundreds of crop and livestock pests; to overcome the effects of floods, droughts, and hurricanes; to get better hogs and cows and poultry; to establish all-year gardens and well-filled pantries; to beautify their homes; and to develop rural recreation and other community facilities for better rural living. Personally and through local leaders, farmer land use planning committees, elected agricultural conservation committeemen, and other agencies in educational work, the extension agents helped millions of farm people toward more profitable farming and more satisfying life.

PLANT SCIENCE IN LAND USE ADJUSTMENT

Basic to all programs of agricultural betterment are facts pertaining to soils and crops. The type of soil cultivated in any area, its fertility, its relative ease of management, and its response to weather conditions largely determine what crops may be produced there and at what cost. To make the best use of a soil type, it is important to know the kinds and varieties of plants that are adapted to it, the most efficient cultural methods, the soil-management practices that best promote low-cost production, and the most profitable ways of harvesting, curing, handling, storing, and transporting the crops. All the natural sciences from geology to meterology, and the social sciences as well, contribute to the required knowledge.

Information of this kind is essential as a guide to programs of soil conservation, land use, agricultural adjustment, range and pasture improvement, watershed protection, farm security, farm credit, land appraisal, and general taxation. The kind and quality

of crop products that can be produced on a given soil determine the livestock enterprises suited to the area, the nature of the industrial utilization of the products, and the handling, storage, and shipping practices required in their distribution. The nutritional quality of crop products is important to the public health. In helping to advance the social and economic welfare of any community, the Department must take account of the physical, biological, and economic factors that govern crop production in that community and shape action programs accordingly.

In seeking facts pertaining to soils and crops, the Bureau of Plant Industry cooperates with other bureaus, State experiment stations, and other scientific agencies. Its research with field and horticultural crops in all parts of the United States pertains to crop culture, production, disease prevention, and harvesting and to breeding and selection for quality improvement and for resistance to cold, drought, disease, insect injury, and other hazards. Studies of the organisms that cause plant disease help to indicate and develop preventive and control measures. The resulting information is indispensable in the Department's action programs.

Recently the Bureau's activities were increased by the transfer to its jurisdiction of the Divisions of Soil Survey and Soil Chemistry and Physics. These Divisions, with the Divisions of Soil Fertility and Soil Microbiology, both of which were already in the Bureau of Plant Industry, carry on combined and integrated soil- and plant-research programs of wide scope.

Detailed soil surveys, published and unpublished, cover more than 1,000,000 square miles, and reconnaissance surveys cover 645,000 square miles. These surveys provide information about the different kinds of soil, their location, and their relative agricultural value. Classified on the basis of internal characteristics such as texture, structure, content of organic matter, and acidity, and of external characteristics such as slope, stoniness, and degree of erosion, soil types are shown on detailed maps. Accompanying and supplemental reports provide additional information.

Also, the Bureau studies the origin of soils and the physical and chemical character of their active components. These investigations deal with the rarer as well as the more common elements in plant growth. Other studies pertain to soil amendments required in the soil maintenance or in the restoration of fertility lost in normal plant growth, through erosion, or from other causes. Microbiological studies provide information on the beneficial or detrimental organisms in the soil and aid in the proper use of inoculants essential to nitrogen fixation by leguminous crops.

Related Crop and Soils Research

Still other investigations pertain to crop rotations and their value in conserving soil fertility, in controlling plant disease, in helping to combat injurious insects, and in affording a pattern for balanced crop production in a given area. Related work provides facts on soil-management practices that insure maximum returns at minimum cost. Rural planning by groups of farmers and public agencies ap-

plies the results in combination with findings in other branches of science. The designation of soil-improving and soil-depleting crops in programs of agricultural adjustment and the formulation of compliance requirements in the choice and use of crops in different regions depend vitally on plant research.

In critical regions such as the southern Great Plains, where wind erosion is acute, the program of revegetating abandoned farm lands and of improving depleted range lands to control erosion requires research and experiment in methods of establishing or of improving stands of grasses under adverse conditions. Specialists in dry-land agriculture provide information on soil-moisture conservation and utilization and on the relationship of seasonal rainfall to moisture penetration of the soil.

Such information is a guide to the time and method of planting crops like Sudan grass and sorghum, the stubble of which protects the soil against blowing until range grasses sown in the stubble become established. Studies of native and introduced grass species help to determine the species most likely to control erosion and to provide good pasturage. Various methods of maintaining and utilizing stands of those species, once they are established, are tried. Federal and State agencies use information on such points in a cooperative attack on the problems of the Dust Bowl.

Buffalo grass that produces a fairly heavy crop of seed and grows high enough above ground so that the seed can be harvested by a mower has been developed. Unimproved buffalo grass is a relatively poor seed producer, and the plants that produce seed generally grow so close to the ground that harvesting is difficult. The new strain, therefore, promises to facilitate a wider use of buffalo grass in revegetation and range improvement work on the Great Plains, where it is highly prized because of its ability to withstand drought and heavy grazing.

Action Agencies Use Plant Findings

In the Southeastern States, research supplies information on cover crops, on green-manure crops, and on adapted pasture crops that are essential to soil conservation and farm adjustment. It gathers facts pertaining to improved fruits, vegetables, nuts, and other crops necessary in diversified or specialized types of agriculture. It deals with the improvement of quality in staple crops such as cotton, sugarcane, sweetpotatoes, and rice. Action agencies draw heavily on the findings.

Plant research in the Southeastern States has shown also the possibility of cotton-quality improvement through cooperation in standardized one-variety communities. This plan of production is receiving encouragement and support from every branch of the cotton industry. More than 1,000 one-variety organizations in 400 of the 850 cotton-producing counties in 16 of the 17 principal cotton States were operating in 1938. The total planted area approximated 2,300,000 acres, having a production of about 1,600,000 bales of improved-quality staple which brought premiums aggregating $14,-

000,000 over what might have been expected from ordinary cotton produced by usual methods on the same acreage.

Corn Belt agriculture in recent years has been greatly benefited by plant research that has provided hybrid corn, improved varieties of soybeans for industrial use, and disease-resistant grain and forage crops. The acreage of hybrid corn in that region increased tremendously after 1935. Simultaneously, the acre yield, the uniformity, the quality, and the disease resistance of the crop improved. Research facilitated the shift to soybeans, mainly for industrial uses, of large acreages formerly used in the production of ordinary corn. It expanded the acreage of disease-resistant cereals and forage crops.

How farmers can save half the work formerly required in controlling bindweed has been revealed by laboratory tests to determine the shifts of food material in the plants as they renew growth after cultivation. Young shoots continue to draw from the old roots for several days and are about 4 inches long before they begin to restore food material to the roots. Thus it has been determined, and clearly demonstrated in the field, that cultivation of bindweed at intervals of 12 to 21 days is as effective in controlling the weed as cultivation at more frequent intervals of 10 days or less.

Plant Disease Research

Plant diseases constantly threaten crops of all kinds, from garden flowers and ornamental shrubs to staple farm crops, vegetables, tree fruits, and forest trees. Programs of agricultural adjustment become more effective when crops can be protected. The control of plant diseases, either by direct methods, such as seed treatment or the use of spray materials, or by indirect methods, such as the breeding of resistant, adapted varieties, is a major objective in the plant-research program. Some of the more serious diseases are transmitted by insect vectors. This fact necessitates close integration of plant research with entomology. Frequently the Bureaus of Plant Industry and Entomology and Plant Quarantine make joint attacks on these diseases. These Bureaus cooperate also in formulating plant-disease quarantines and regulations.

By breeding resistant varieties, the Bureau of Plant Industry, in cooperation with various State agricultural experiment stations, makes possible continued production of high-quality crops in spite of disease epidemics. Varieties of small grains have been developed that are resistant to leaf rust, stem rust, smut, bunt, etc.; corn hybrids that are more resistant than common varieties to ear and kernel rot diseases. Other results of research and experiment include hops more resistant to mildew; alfalfa highly resistant to bacterial wilt; nematode-resistant grape root stocks; a potato practically immune to two of the most common virus diseases; mildew-resistant cantaloups and lettuce; sugar-beet varieties resistant to curly top; flue-cured types of tobacco resistant to black shank; disease-resistant vegetables and flowers; fruits of higher eating and shipping quality; and many other varieties of different field and horticultural crops resistant to one or more serious diseases.

In cooperation with the Forest Service, the Bureau of Plant Industry studies methods of preventing or controlling the diseases of forest trees. The chestnut blight, the Dutch elm disease, the white pine blister rust, persimmon wilt, the London plane disease, a serious bark disease affecting beeches, and several diseases of willows are among the many diseases requiring additional study. The menace of these diseases lies not only in the potential destruction of the trees themselves but also in the effect of their destruction upon soil and water conservation, flood control, fuel, and lumber supply. The menace extends also to the reduction of food supplies of wildlife dependent upon fruits and nuts. The introduction and spread of tree diseases is favored by improved transportation facilities in international commerce, by automobile travel, and by air transportation. Pathologists consequently are pressing their researches in an effort to isolate and identify the various disease organisms and to devise methods of controlling or exterminating them.

Drug That Multiplies Chromosomes

In their effort to develop new and more useful crop varieties, plant scientists recently have found a useful tool in colchicine—a powerful poisonous drug which has the effect of doubling or redoubling the number of chromosomes normally found in the species treated. Colchicine is being used experimentally in improvement work with cotton, flowers and other ornamentals, certain cereals, tobacco, fruits, grasses, and other crops. Besides making possible successful plant crosses that heretofore have been impossible, colchicine modifies the growth habits of plants and in general extends the range of variability within species. This phenomenon opens new fields of research that promise results of tremendous value to agriculture. There are in prospect, for example, cotton hybrids carrying the resistance to drought, disease, and insects, long recognized in certain wild species of cotton but never before utilized in cotton-improvement work. Tobacco hybrids, made possible by colchicine treatments, promise wider, thicker leaves of a type used in the production of insecticides. Improved flavor of berries and a wider adaptation of certain cool-weather fruits are the possibilities that colchicine brings to small fruits. Many other promising hybrids have been produced and are under observation, but their true values remain to be determined.

The results of investigations with plant hormones have been of great value in the propagation of plants, in the setting of the fruits of some plants without pollination, and in modifying or accelerating the growth of certain plants. Fundamental research with respect to hormones and to the effect of light as modified by the length of day promises to furnish new and important information relative to the physiology and reproduction of plants.

No longer is quantity the sole measure of crop production. Nutrition studies have shown the need for attention to the quality of food and feed. As a result of both inherent and environmental factors, the chemical composition of crop plants varies. Many phases of

the relationship between chemical composition and nutritional value remain to be investigated. There is evidence, however, that the nutritional values of crop plants are modified by soil types, soil amendments, climatic conditions, processing methods, and genetic factors. This brings the research of the Bureau of Plant Industry into close alinement with that of the Bureaus of Agricultural Chemistry and Engineering, Animal and Dairy Industries, and Home Economics.

Pasture improvement calls for species of pasture plants that are both palatable and nutritious to livestock. Grasses that possess this combination of qualities will promote the health, growth, and fecundity of the animals, will condition them desirably for the market, and will increase the output of animal products per acre of pasture land. Pasture-improvement methods are evaluated through cooperative research not only in terms of herbage yield but in terms of animal use of the herbage. Cooperative nutritional studies indicate also the value in the human diet of various crops produced, harvested, stored, and marketed under different conditions.

The Competition of Substitutes

The advance of science and industry provides many substitutes for staple commodities, to which consumers will turn readily when price differentials justify such action. Food crops must be of finer texture, higher flavor, more attractive color, and better keeping quality. Fiber must be of better textile strength, more uniform length, and finer quality. Methods of handling, storing, packaging, and shipping must be developed to preserve the improved qualities. Plant research extends to all these factors. It makes some crops more suitable for preservation by freezing. It adapts them better for refrigerated transportation over long distances, sometimes 2,000 or 3,000 miles or more. Shippers and growers have benefited by the transportation and storage investigations with special reference to the precooling of cars and pre-icing. These, together with proper ventilation and loading, have made it possible greatly to reduce the shipments, with a consequent reduction in refrigeration charges and no loss of quality.

In storage fumigation tests with sulfur dioxide to inhibit mold growth in Emperor grapes it was found that frequent light fumigations were more effective than less frequent and more toxic ones. Successful storage during 10 weeks resulted from weekly fumigation. In freight shipments of cherries from the Northwest to eastern markets, the use of carbon dioxide in transit to supplement ordinary refrigeration proved successful in enhancing the keeping quality of the fruit. Storage experiments with apples show the usefulness of prestorage treatment with carbon dioxide in preventing soft scald and soggy break-down and in improving the quality of the fruit as well as in prolonging its storage life. This treatment also aids in controlling common scald, Jonathan spot, and internal break-down in apples.

PROGRESS IN ANIMAL INDUSTRY

Through continued advancement in knowledge of animal production and control of disease, the Nation's livestock industry is attaining an increasingly secure position. The security is further enhanced by the vigorous administration of quarantine laws, interstate inspection, and other protective features that, collectively, have made the United States widely recognized as the safest country in the world in which to raise livestock. This attainment illustrates in convincing manner the ability of a democracy to govern its people firmly and efficiently, to the point of scientific precision, but with their ready consent.

A half century ago when farm animals were dying at an alarming rate and foreign governments questioned the wholesomeness of certain meat exports from this country, Congress established, in the United States Department of Agriculture, a Federal unit, the Bureau of Animal Industry, with authority to interfere, if necessary, with the free movement of livestock and their products in commerce. In time, State legislatures granted authority even to destroy a farmer's livestock on his own premises when infection harbored there constituted a danger to other animals in the community.

Needless to say, such depredations on the farmer's livestock at first impressed many persons as a high-handed, un-American procedure. But, given time to think the situation over, the discerning American farmer came to realize that his own interests are indissolubly bound up with the interests of the community. The tremendous influence which this branch of the Department brought to bear in paving the way for other types of cooperative control, toward beneficial ends, is a major contribution to the welfare and progress of the Nation.

Types of service, currently rendered, include both research and regulatory activities, of which the following are noteworthy examples.

Livestock Breeding

The essential place of livestock in the agriculture of the United States is well established, but new conditions make it increasingly desirable that improved types of livestock be developed.

In beef cattle, practically the only standard of excellence, since the establishment of the various breeds, has been show-ring performance. Repeated tests have shown the need of perfecting methods of evaluating breeding animals for efficiency of gain and quality of product. Through the Department's progeny-testing methods there are prospects of materially increasing efficiency in beef production and at the same time producing carcasses that conform to consumer demand.

The South, especially the Gulf Coastal Plain, is notably deficient in good-quality cattle that thrive in that environment. Research by the Department has shown the deleterious effect on cattle of high temperature and humidity. When temperatures in the shade rise above 70° F., respiratory rate and temperature of beef cattle of the breeds commonly raised in the United States are greater than those of Brahman (Zebu) cattle, which originated in India. Brahman cattle show greater efficiency in disposing of excess body heat when exposed to

the sun in hot weather. Under conditions in which domestic cattle spend as much as half of their time resting in shady places to avoid the heat, Brahman and crossbred (Brahman × Angus) cattle spend practically all their time in the sun either grazing or resting. On the basis of these observations, cattle produced in the Gulf coast area may be materially improved by breeding for greater resistance to heat and humidity.

In horse-breeding studies at the United States Range Livestock Experiment Station, Miles City, Mont., the possibility is indicated of greatly raising the average level of fertility in studs. Through an accurate check on the reproductive cycle of more than 70 mares and with insemination timed to coincide closely with ovulation, the level of fertility in this study was raised from about 50 to 80 percent.

A new study of potential importance to the sheep industry concerns the rating of the fleece of a sheep early in the life of the animal. Results thus far indicate that a breeder can evaluate the quality of wool of the mature sheep rather accurately from the weanling fleece. Such a method, when perfected, will enable breeders to rate their sires 1 year sooner. It has the added advantage also that the rating can be based on all weanling lambs rather than, as customary, on the selected ones retained to 1 year of age.

The use of artificial insemination as a factor in livestock improvement continues to be of wide scientific and popular interest. In the Department's studies on long-range insemination of sheep, a total of 31 pregnancies from 309 inseminations were obtained with semen that had been shipped by plane for distances ranging from 700 to 2,600 miles. The longest interval between collection of the semen and insemination that resulted in pregnancy was 115 hours. These results suggest that long-range insemination of livestock is not yet within the reach of the average breeder although it has been successfully accomplished experimentally.

In studies on boar and horse semen, techniques were developed which make it possible to store semen from these two species for 24 hours. Hitherto it has been very difficult to store semen from boars and stallions. This is a development of first importance in connection with practical artificial insemination of these species.

A mathematical study of poultry records has shown that a hen's total egg production can be predicted with a reasonable degree of accuracy if trap-nesting is done 1 day a week through the laying year. Such a system of trap-nesting should be advantageous to practical poultrymen or farmers who have not the time and money to do daily trap-nesting. Selection of breeders by trap-nesting 1 day a week would be a vast improvement over the common method used by poultrymen of selecting their breeders by external characteristics.

Animal Nutrition

A changing agricultural economy, accompanied with increased use of pasture and forage, has focused attention on the possible nutritional deficiencies affecting beef cattle whose rations contain a comparatively large proportion of roughage. Experiments have

shown that cattle receiving rations deficient in one or more nutrients are inefficient beef producers. This means increased production cost, a result unfavorable to both producers and consumers.

An extensive survey and analyses of soils and vegetation in southern Texas have shown a pronounced phosphorus deficiency in that section. Blood analyses of cattle likewise reflect this mineral deficiency. An experiment conducted near Falfurrias, in cooperation with the Texas Agricultural Experiment Station, has shown that phosphorus deficiency in range cattle can be corrected by feeding small quantities of this element either in the form of bonemeal or disodium phosphate.

In the production of beef cattle, as with other animals, an inadequate supply of vitamin A adversely affects growth and development, health, and reproduction. Vitamin A deficiency also often results in blindness. The need for this vitamin or the substance, carotene, from which it is formed, requires particular attention in areas subject to drought, especially those in which animals live largely on forage and some cereal grains.

Carotene is gradually destroyed as feed is stored and often almost completely disappears after about a year. In sections where hay is stored for a year or more against periods of feed shortage, the vitamin problem is highly important. In such cases a source of carotene should be provided. This may be any green, well-cured feed, or possibly fish oils. Likewise, the best utilization of available feeds in some regions, such as cottonseed meal and hulls in the South and Southwest, requires the addition of a supplement containing carotene or vitamin A.

Cattle store considerable quantities of carotene when they have access to green forage; hence the period over which they can be carried on a low-carotene ration varies. The onset of night blindness is evidence of depletion of carotene in the body. So far, experimental results indicate that calves are not likely to develop blindness in less than 85 days after a dry season, and in some cases the time has been as long as 206 days. On moderately low intakes of carotene, calves have yielded satisfactory carcasses during short periods of fattening. Pending more definite information on carotene requirements, a good guide is the result obtained at the Texas station, that 2 pounds of new, green, leafy alfalfa hay daily is sufficient.

In poultry feeding an extensive study of the effect of different levels of protein intake on growth of chickens and turkeys yielded results having a definite bearing on feeding efficiency and economy. On the basis of the quantity of feed required per pound of gain in live weight, the best level of protein intake for growing chickens was found to be about 21 percent of the total feed intake. As the level of protein intake increased or decreased from this value, smaller gains in live weight were made per pound of feed. Turkeys were found to make satisfactory growth when the protein content of the mash ranged from 18 to 30 percent, at least 7.5 percent of the mash being protein from animal sources. The data obtained in this study make it possible to estimate which of two well-balanced diets of different protein content and different purchase price will be the more economical.

The belief that carcasses from animals fed cottonseed meal and hulls were inferior to those fed corn led the Department, in cooperation with the South Carolina station, to compare the results obtained, in the fattening of cattle, from the feeding of large quantities of cottonseed meal and from the feeding of corn. The meal was fed with and without the addition of forage containing carotene. No differences were found between equally fattened animals during the average fattening period.

National Poultry Improvement Plan

During the year the National Poultry Improvement Plan, which provides uniform standards for the production of hatching eggs, baby chicks, and poultry breeding stock, was adopted in 2 additional States, Maine and Tennessee. With this addition, a total of 44 States are cooperating with the Department in the plan to improve the production qualities of poultry and to reduce losses from pullorum disease.

More than 42,000 flock owners had their 8,500,000 breeding birds selected and tested according to the provisions of the plan during 1939. These flock owners furnished eggs to the 2,033 participating hatcherymen, whose hatcheries had a combined capacity of nearly 76,000,000 eggs. It is estimated that about 152,000,000 chicks were hatched under the provisions of the plan during the year, or nearly a fourth of all chicks raised on farms in the United States.

Since the inauguration of the plan, 14 States have begun a pullorum-control program. More than a thousand pullorum-testing agents operated under the plan during the year. More than 4,500,000 birds were tested, of which 3.44 percent were reactors. In this work, the rapid, whole-blood test, developed by Department research workers, is being used in most of the participating States.

Reduced Danger From Stock-Poisoning Plants

Information on plants poisonous to livestock has been collected by the Department over a period of many years. Lately such data have been valuable in the work of the Soil Conservation Service as regards the type of plants to be used in soil-conservation plantings. Certain plants that are good soil binders are dangerous to livestock. Dependable knowledge regarding such plants has thus prevented new plantings that would have created a hazard to livestock in the future.

Studies of stock-poisoning plants have been helpful to livestock owners, also in the management of cattle and sheep on western ranges. The presence there of larkspur, a poisonous plant, had made it dangerous to use large areas of grazing land in the customary manner; but a study of the situation showed that, although cattle were injured by larkspur, the plant was not dangerous for sheep and horses under usual conditions, particularly after it had made some growth. In the light of this knowledge, it became possible to manage the range so as to keep cattle out of the larkspur areas and utilize these areas for sheep and horses. It was further discovered that after the larkspur had gone to seed it was no longer dangerous

for cattle, so that late in the summer the larkspur ranges could be utilized for cattle. In this way many square miles of range land that might otherwise have been left unused, or pastured by cattle with subsequent loss, were restored to full utilization with resulting large economic savings.

Quarantines Effectively Maintained

As in the past, the Department conducted veterinary inspection and administered laws and regulations designed to prevent the introduction of serious diseases prevalent in foreign countries. As a result, the United States remains free from foot-and-mouth disease, contagious pleuropneumonia, surra, rinderpest, and other destructive communicable diseases of animals. Foot-and-mouth disease is prevalent in most countries of the world outside of North America and Central America and from time to time causes enormous losses. Spreading with almost unbelievable rapidity, it is probably the most contagious disease known to science.

Supervision of Veterinary Biologics

In its administration of the virus-serum-toxin law, the Department has sought to establish and maintain a high degree of purity and potency for biological products used in the treatment of animals. When these products are not effective or are otherwise unsatisfactory, the farmer or livestock owner not only is handicapped in controlling outbreaks of communicable diseases in his animals, but also through the use of worthless and perhaps dangerous products he is put to a useless expenditure of money and may even jeopardize other herds in the community.

During the year the Department began to exercise more stringent control over the importation of organisms or vectors from foreign countries that may convey infectious diseases to our domestic animals. Amendment 14 to Bureau of Animal Industry Order 276 provides that no organisms or vectors may be admitted from a foreign country unless a permit for their entry has been issued by the Secretary of Agriculture.

A comprehensive study of the problem relating to the production and marketing of biological products under United States veterinary licenses was conducted during the year, and changes are being made in the labeling and advertising of these products. These changes will inform farmers, veterinarians, and other users of veterinary biologics of their composition and proper use, in a more satisfactory manner than heretofore. Misleading names and recommendations not justified by the composition and action of the products are not permissible under existing laws and requirements.

Tuberculosis Eradication

In the Federal-State project to eradicate bovine tuberculosis, veterinary inspectors made approximately 11,000,000 tuberculin tests during the year. These disclosed about 60,000 cattle, or 0.5 percent,

as reactors. Much of this testing was follow-up work to remove centers of infection, located from time to time in so-called modified accredited areas, which signify that infection of tuberculosis has been reduced to less than 0.5 percent. Of the 48 States, 47 have qualified for this designation. In the remaining State, California, 5 additional counties were so designated by the Department during the year, leaving (on August 1, 1939) only 8 counties in the entire United States—all located in California—yet to attain the modified accredited goal.

In connection with the retesting of cattle in modified accredited areas, it is noteworthy that no county, once having so qualified, has ever been removed from that classification because of recurrence of the disease. Retesting must continue for many years because of its economic and human-health aspects.

With the exception of California, only 0.2 percent of infection was found throughout the United States, indicating that the percentage of infection in the modified accredited areas is much below the minimum requirements.

Progress in Bang's Disease Control

Bang's disease continues to be a serious menace to both the beef and dairy industries. In the cooperative Federal-State project, begun about 5 years ago, for the control of this disease, the procedure consists in the testing and slaughter of infected cattle, followed by the application of sanitary measures and the retesting of herds at suitable intervals. The work is conducted on both an individual-herd and area basis.

Under the individual-herd plan, owners who desire to eliminate the disease are assisted in following approved methods. In several States, when herds have passed the required number of tests they are certified by the State as free of the disease. The number of such herds now exceeds 64,000, containing more than 1,000,000 cattle. The cattle in these herds, especially purebred animals, have an increased value when sold for breeding purposes. Dairymen in particular are further benefited through being able to maintain their herds in a more profitable manner because of increased milk and calf production.

The area plan consists in testing all the dairy and breeding cattle more than 6 months of age in a given territory and removing the reactors for slaughter. The plan has proved to be very satisfactory in areas where the infection is not high and where owners are especially interested in the work. This phase of Bang's disease control has been conducted in 422 counties located in 22 States. When the degree of infection has been reduced to less than 0.5 percent, the counties are eligible for official certification as Bang's disease accredited areas.

During the fiscal year agglutination blood tests to combat Bang's disease were applied to approximately 7,600,000 cattle, of which 2.8 percent reacted and were slaughtered. At the close of the year, more than 11,000,000 cattle were under supervision in this project.

It has been recognized by those making blood tests of animals in the various States that dependable and uniform results depend on a

carefully standardized antigen. Veterinary workers have called attention to variance in the antigens prepared by the various State laboratories and have repeatedly expressed the desire that the Bureau of Animal Industry of this Department undertake the production of antigen to be supplied to all laboratories engaged in official testing. Accordingly, the Department has equipped the laboratory at its Animal Disease Station with facilities for the production of all antigen used for that purpose, and arrangements were made to commence distribution July 1, 1939. This undoubtedly will result in a more uniform interpretation of the blood tests throughout the country.

Since last year's report on calfhood vaccination against Bang's disease, approximately 11,500 calves between the ages of 5 and 7 months vaccinated in 261 herds have furnished further encouraging results. Data accumulated on these tests show that the vaccination of calves in infected herds increases their resistance to infection during their first and second pregnancies and also, in the case of the limited numbers for which data are available, through their third pregnancy. It is deemed advisable, however, to continue observations on these herds before arriving at definite conclusions.

Further Advances in Cattle Tick Eradication

In the South and Southwest, where cattle raising was long handicapped by the ravages of cattle ticks, the successful eradication of this pest is producing many benefits. The quarantined area, which originally included about 729,000 square miles in 15 States, has been reduced to about 14,000 square miles in 2 States, Florida and Texas. During 1939, the cooperative work of eradication advanced further in those States and also in Puerto Rico, where Federal quarantine is likewise maintained. Additional areas will be in condition for release from quarantine at the end of the active dipping season, about December 1. Eradication of cattle ticks in the Virgin Islands began this year.

Livestock Trucking in Relation to Disease

In connection with both the marketing of livestock and the veterinary inspection of such animals shipped interstate, new problems have arisen, caused principally by the great increase in livestock marketing by motortruck.

Normally about 20,000,000 cattle, 24,000,000 sheep, and 22,000,000 swine pass through the principal markets, in the course of a year, in interstate commerce. These animals are inspected for disease by trained employees of the Bureau of Animal Industry. Affected animals and those exposed to disease are treated under supervision and disposed of in a manner which prevents contagion from spreading to animals in other States. The origin of the diseased animals is determined and reported to the authorities of the State concerned. This phase of the work is highly important; frequently the first information received by a livestock sanitary official of an outbreak of disease in his State is furnished through the report of a Department employee at one of the central markets.

Certificates are issued covering the interstate shipment of animals free from disease and of those which have been properly treated. Cars, trucks, and other vehicles and premises which have contained diseased animals are subject to cleaning and disinfection, under supervision. These operations are conducted on a large scale.

The type of supervision described has been greatly complicated, however, with the advent of the motortruck as a principal livestock carrier. At a representative market, during June 1939, only about 16,000 cattle were received by rail as compared with 70,000 by truck. For sheep the corresponding figures, in round numbers, were 37,000 and 99,000; and for hogs, 2,000 and 25,000. Thus in all cases truck shipments were noticeably predominant. The mobility of the truck makes it possible to deliver diseased animals to the stockyards and depart before the infection is discovered. Moreover, the truck may be used again before it can be traced and disinfected, whereas the railroad stock car which has contained diseased animals can be easily traced and cleaned and disinfected, in nearly every instance, before being reloaded.

In the transportation of livestock, losses due to improper loading, feeding, watering, and yarding are largely avoidable, and one of the functions of the Department is to enforce the laws enacted to prevent such losses. The 28-hour law, when properly complied with, causes the animals to be unloaded for rest and proper feeding and watering at stated intervals. Handling livestock in conformity with the provisions of this law prevents much suffering and shrinkage, and the animals are delivered at their destination in the best condition possible. At the time this law was enacted motortrucks were not a factor in livestock transportation and, therefore, no provision was made for the proper handling of livestock shipped interstate by truck. However, reports have been received of long-haul truck shipments of animals which have been handled in an inhumane manner, and efforts are being made to have the present law amended so that it will cover truck as well as railroad shipments of livestock.

AGRICULTURAL CHEMISTRY AND ENGINEERING

Reorganization of the Department last year brought agricultural chemical research and some agricultural engineering research together under unified direction in the new Bureau of Agricultural Chemistry and Engineering. Both these lines of work promote more efficient farm production and also the conservation of agricultural resources, and the integration of them under unified direction gives better results.

Chemical investigations have an engineering counterpart in many farm-production problems. For example, chemical research shows how better and cheaper fertilizers can be produced. Engineering studies help to determine the most advantageous placement of fertilizers for different crops, and influence the design of fertilizer-distributing machines. Similarly, chemical investigations with regard to composition of the soil influence the improvement of equipment for soil preparation. Investigations of methods for producing weed killers lead naturally to the study of the machinery for dis-

tributing such materials. Agricultural chemistry and agricultural engineering have a common interest in spraying devices and other means for the control of insects and fungus diseases.

In the conservation of the soil, chemical research plays an important role. Engineering research backs it up. Conservation work through erosion control and soil building draws equally on chemical and engineering knowledge. Similarly, what might be called the conservation of agricultural products, or the prevention of losses from waste and spoilage, has both chemical and engineering aspects. Chemistry and engineering come together in the prevention of farm fires and dust explosions; in the construction of silos to withstand the chemical action and pressure of their contents; and in the transportation of farm products under refrigeration, Chemical investigations in the treatment of eggs for storage, in the preservation of hides and skins for tanning, in the prevention of rancidity in oils and fats, in the handling of turpentine and rosin, and in many other fields make tasks and problems for the agricultural engineer.

Farm-Product Utilization

Chemical studies in the utilization of agricultural products often involve engineering or mechanical problems. Studies of sugars in sugar-bearing plants, of cellulose, hemicellulose, and lignin in crop wastes, of starch and inulin in root crops, of oils in seeds, of proteins in grains and other seeds, and of tannin in various plants and plant parts often indicate processing requirements that draw on engineering technology. Research in the nutritive value of agricultural food products has implications for agricultural engineering, since many food products must be processed mechanically. Chemical investigations in the better preparation of cotton are supplemented by engineering research in drying, cleaning, and ginning processes.

Research to develop new uses or to expand the existing uses of agricultural products brings chemists and engineers into collaboration. Chemical processing offers the greatest hope for new or expanded uses for agricultural materials. In the Agricultural Adjustment Act of 1938, Congress authorized the establishment of four regional research laboratories, one in each major farm-producing area. These regional laboratories are now under construction at Peoria, Ill., New Orleans, La., Wyndmoor, Pa., and Albany, Calif. Operation of them has been delegated to the Bureau of Agricultural Chemistry and Engineering, which will use them to expand greatly its research work into chemical, technical, and industrial uses of farm products and byproducts.

In research of this type chemistry does not proceed alone; other sciences play a part, notably economics and engineering. Solution merely of the technical problems involved is not enough. It is necessary also to develop mechanical facilities for applying new or improved processes and also to coordinate the total technology with the economic or financial requirements of commercial operation. Three main types of research will be undertaken by the regional laboratories: (1) Studies to promote the application of existing

knowledge concerning the properties and uses of farm commodities to the expansion of present outlets; (2) study and development of new processes on a small plant scale; and (3) fundamental research to develop new knowledge and if possible to establish entirely novel methods of product and byproduct utilization. These investigations will draw on economics, biology, chemistry, and physics. They will involve close cooperation with State agencies, educational institutions, and industries.

Coordination of Utilization Studies

In a report to the Congress, which was published as Senate Document No. 65, Seventy-sixth Congress, first session, the Department indicated how its research in the utilization of farm products and byproducts will be coordinated with related research. Chemists, engineers, economists, and other scientists cooperated in preparing the report. They surveyed research activities of the Federal and State agencies, of educational institutions, of privately endowed research organizations, and of commercial research laboratories. Analysis of more than 10,000 current research projects showed that more than 150 of them relate closely to the development of new or extended uses for agricultural materials. Commodities that will receive first attention in the regional laboratories are: Corn, wheat, and crop residues in the northern; cotton, sweetpotatoes, and peanuts in the southern; tobacco, apples, potatoes, milk products, and vegetables in the eastern; and fruits, vegetables, potatoes, wheat, and alfalfa in the western.

Chosen because of the number of agricultural workers affected, because of the magnitude of the existing surpluses, or because of the size of the farming areas involved, these commodities present varied and yet related problems. Comprehensive and cooperative attacks on these problems will undoubtedly accomplish more than piecemeal or fragmentary research could accomplish. It should be realized, nevertheless, that research works slowly. Probably several years must elapse before important results can be expected. Moreover, as already indicated, the practical utilization of agricultural products by new processes involves economics as well as technology. Findings of chemistry and engineering generally run ahead of the practical application—sometimes by many years. Certain large-scale uses to which agricultural products could be adapted must run the competition of raw materials from mineral sources. After technology has shown the practicability of a given process, questions remain to be decided as to cost of production or as to the possibility of finding adequate markets. There is the inertia of habit to be overcome and also the disinclination of manufacturers to scrap old equipment.

Prompt Application of Many Findings

Nevertheless, new discoveries in processing equipment and practices sometimes come into use quickly. This Department has made a number of discoveries in recent years that have had prompt application. They include the following: Improved catalysts, equipment,

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and technique for the production of synthetic ammonia from hydrogen and atmospheric nitrogen; a process for the synthesis of urea; furnace processes for the production of phosphoric acid from phosphate rock; a process for granulating fertilizers to prevent segregation of constituents; the addition to fertilizers for some soils of minor plant-food elements such as manganese, copper, magnesium, and zinc; a process for retarding the development of rancidity in vegetable oils and oil-bearing foods; methods of developing natural color in citrus fruits; methods for loosening the hulls of sticktight walnuts; a process for obtaining furfural from crop wastes. Indeed, the list could be extended greatly.

In recent years there has been a tremendous increase in the production of citrus fruits. Chemical research and related work in the Department promotes industrial utilization of citrus surpluses, particularly of off-quality and off-size portions of the crops. Diversion of the culls from the fresh product is essential to maintain good prices for the bulk of the crops. Technological research in the Department has facilitated this operation greatly. It has brought about continued improvement in the quality of canned fruits, fruit juices, and of other fruit products. In 1937, for example, the pack of fruit juices exceeded 24,000,000 cases, as compared with only about 1,000,000 cases in 1929. About 16,000,000 cases of tomato juice were packed besides. Research in the Department has helped the rapidly growing frozen-foods industry.

The Department is trying to develop standards for crude pine gum so that transactions in this commodity may be on a fair basis. Numerous farmers in the Southern States are working available pine timber for turpentine gum and selling the gum to owners of turpentine stills. The potential production of turpentine and rosin is increasing rapidly, as a result, in part, of the voluntary regrowth of pine timber on cut-over land. The output will probably increase greatly. Farmers who extract the turpentine gum and sell it to turpentine distributors have an obvious interest in the development of better standards for the crude product. Also, with a view to providing markets for the increased production of naval stores the Department is studying the composition of the crude gum and of gum spirits of turpentine. It is investigating methods for isolating the components, and testing the utility of these components for various industrial uses.

Many small-scale farmers produce sugarcane and sorgo sirups both for their own consumption and as a source of cash income. Chemical and technological research in the Department helps them to improve the quality and increase the uniformity of these products. Studies are under way with the hope of arresting an apparent decline in beekeeping, which is important not only as a source of honey but as a means of cross-pollination in fruit growing.

Research Regarding Crop Storage

In connection with the A. A. A. programs chemical and technological research determines the conditions necessary for the safe storage of crops and indicates suitable designs for storage structures.

Findings have already been published on the storage of corn, wheat, and potatoes. Studies of the changes that take place in the proteins of grains and of other seeds in storage and on the baking quality of flours, as affected by the storage of wheat, have a bearing on the ever-normal-granary programs. Lespedeza, which is valuable as a soil-holding crop, contains tannin. It is important to keep the tannin content low so that the plant may be more acceptable to cattle. Chemical investigation of this problem which has an important connection with the control of soil erosion, is under way. Studies in the industrial utilization of minor crops have a bearing on the national agricultural programs. For example, cooperative research in the utilization of sweetpotatoes for starch manufacture, in the industrial utilization of soybean products, in the utilization of tung nuts for drying oil and byproducts, and similar work makes in the aggregate a significant contribution to the task of crop adjustment.

ACHIEVEMENTS OF THE STATE EXPERIMENT STATIONS

More than 50 years have elapsed since the Congress established a system of State agricultural experiment stations in connection with the land-grant colleges and universities. These institutions have been continuously maintained in conformity with the Hatch Act of 1887. Provision for them has been supplemented greatly by the Adams Act of 1906, the Purnell Act of 1925, and the Bankhead-Jones Act of 1935, and even more extensively by State legislation. Congress has provided increased funds for agricultural research by the Department itself. The resulting State and Federal work has been carried out through the development of a group of research institutions with separate identity and yet with unity of purpose, function, and obligation.

Problems of an immediately practical nature were formerly so numerous and pressing that but little attention could be given to work of a more fundamental character. Questions concerned with the choice of crop varieties, with fertilizers, with rotations, with feeds for livestock, with insecticides and fungicides, with the control of parasitic organisms, and with weed control demanded first consideration. But the answers obtained through simple techniques and through trial and error usually did not go deep or apply broadly to other problems similar in character. As opportunity permitted, research workers began to explore the more basic aspects of the problems, and such fundamental study proved of great practical value. Discoveries of basic laws had wide application. Much research in the Department and the affiliated State institutions is now of this character.

Much early investigation was in the field of animal nutrition. Fundamental studies revealed, contrary to the prevailing belief, that like amounts of food ingredients do not necessarily produce like effects, and that there are great differences, for example, in the constitution and value of proteins from different sources. It had long been recognized that nitrogenous compounds were essential in animal nutrition and that proteins are the primary source of nitrogen in the

ration. It remained for the Connecticut Agricultural Experiment Station, in collaboration with Yale University, to show that certain proteins which resulted in nutritive failure when fed alone could be rendered adequate by the addition of certain amino acids. The body is unable to synthesize many of the amino acids essential to normal body functions and they must be supplied in the food. Hence these experiments led to the fundamental conclusion that the value of a particular protein in nutrition may be determined by its amino acid make-up. This research provided a basis for evaluating feed proteins as to their biological value and for providing a balanced protein ration. It profoundly affected feeding standards and practices on the farm.

Rust Resistant Wheat

In 1909 the Minnesota Agricultural Experiment Station in cooperation with the Department began a thorough study of grain rusts. More knowledge of the microscopic fungi that cause rust epidemics had become essential. The result was the discovery of a multitude of biological races of rusts; of means for identifying them; of ways by which they originate and spread; and of types of resistance that occur in different wheats and other cereals. This knowledge led to new methods in breeding wheat for rust resistance and changed disappointment into success. A new wheat variety, Thatcher, was brought into being which had multiple resistance to many rust races and also possessed high milling and baking quality.

This variety gave a striking demonstration in 1938. Some 4,000,000 acres planted with Thatcher in that year survived a widespread stem rust epidemic in the Red River Valley and also gave an increase of some 33,000,000 bushels of high-quality grain over what its best predecessors in that area would have yielded under the attack. The estimated return in that year of more than $11,000,000 to the farmers of Minnesota from the use of Thatcher wheat was many times the total amount spent by the State in support of grain-rust research. Using the knowledge of leaf rust strains that began under the same investigations, the North Dakota station in cooperation with the Department has developed two new varieties of high yield and quality that carry multiple resistance to both stem and leaf rust. Still other resistant selections are being tested by thousands to find types suitable for other sections of the country.

Discoveries in Potato Disease

The outcome of research on potato virus is another striking example of the value of basic studies. No vegetable is more widely grown or used in North America than the potato, but potato growing has been full of hazards. Even after the serious late blight disease was brought under control by scientific spraying methods there remained an unexplained deterioration in yields or so-called degeneration, for which no fungus, bacterial, or insect pests appeared to be responsible. Prolonged study by the Department and various State experiment stations cooperating in basic research revealed that

the major cause of the continued decrease in yields lay in the group of infectious diseases caused by plant viruses, such as leaf roll, the mosaics, and spindle tuber.

Investigation showed that these viruses are usually spread by insects and are invariably transmitted through the tubers from one generation to the next. The current system of seed potato certification now established in most States is based on the fact that with safeguards worked out in accordance with research findings, seed potatoes can often be produced so free from viruses, as determined by field inspections, that they can be sold to growers throughout the country as officially certified seed stocks. Through this system, the steady downward trend of potato yields has been reversed. In 1937 over 72,000 acres of seed potatoes were passed for certification. The yields of these certified acres surpassed those for the county as a whole on the average by more than 86 bushels per acre and produced enough to plant over a million acres with superior stock the next year.

Research the Basis of Hybrid Corn

Hybrid corn is also an outstanding proof of the power of fundamental research to revolutionize crop practices. Corn hybrids have established their superiority in productiveness and in resistance to lodging, disease, and other unfavorable conditions. The new method of breeding was suggested by the research started in 1905 by G. H. Shull, of the Carnegie Institution, and E. M. East, of the Illinois (and later the Connecticut State) station. The experiment began in the isolation of desirable inbred lines that breed true, in the determination of the more productive lines, in cross-breeding, and in the utilization of the superior crosses in commercial production. Workers in the Nebraska and Minnesota stations and in the Department and a private breeder started corn-inbreeding projects. Extensive adoption of the method came slowly at first, because of mechanical difficulties in using hybrid seed and because of lack of thorough knowledge of the theory. It became more rapid with better understanding of the inheritance of characters and of the phenomenon of hybrid vigor and the use of double crosses.

Projects of the experiment stations in corn breeding began to increase in number soon after 1920. Cooperative corn-improvement work, between the Department and the experiment stations, economized research resources, developed the interchange of breeding material, and promoted far more rapid progress than otherwise would have been possible. Today many experiment stations and a number of private breeders are engaged in isolating and testing inbred lines in hybrids. Hybrid corn has returned profit to both seed producer and corn grower. The peculiarity of the phenomenon that restricts its use to the first generation and requires that new seed be obtained each year has resulted in the development of a sizable industry for seed production. Unusual opportunities are offered for the breeding of kinds suited to specific environments or possessing special characteristics of value to the feeding or milling industries.

Selenium and Fluorine Problems

Typical of benefits from cooperative research are the results on the selenium problem. Some years ago a type of animal disorder previously designated as alkali disease or blind staggers was observed in certain areas of the Great Plains. Investigation by the South Dakota station showed that the disease was caused by the feeding of crops grown on localized soil areas. Cooperative studies by the Department and the South Dakota and Wyoming stations then proved selenium to be the specific cause of the disorder. This research also made possible the mapping of soil areas potentially dangerous because of the presence of selenium and the establishment of tolerance levels of selenium in food and feedstuffs which may be considered safe for human or animal consumption.

It has long been known that large doses of fluorine are toxic to man and animals. Only recently has it been determined that rations containing fractional percentages of fluorine are injurious to the animal organism, especially when ingested continuously. Findings by the Arizona station on the effect of fluorine on human teeth, and by the Wisconsin, Michigan, and Ohio stations on the effects on the bones and teeth of various species of animals and of toxic levels of intake for various species has led to the treatment of feeds and waters so as to avoid or minimize the adverse effects.

Livestock Research

Studies in the physiology of reproduction in farm animals, cooperative between the Department and the University of Missouri, have established important fundamental facts on the estrus cycle and time of ovulation in female sheep, swine, and horses, and on conditions affecting sperm production in the male of these species. The findings have wide application in the rapidly developing practice of artificial insemination of farm animals.

Cooperative meat investigations have yielded much significant information on quality factors. For example, studies begun in 1919–20 on factors underlying the problem of soft fat in pork demonstrated the existence of a direct relationship between the quality of the fat in the ration and the quality and hardness of pork fat. Soft fat was shown to be directly attributable to a high percentage of highly unsaturated fatty acids in the ration. This research pointed to the need of limiting such feeds as peanuts and soybeans in swine fattening rations, and showed the safe levels for such foods that may be fed at various stages of growth and fattening.

Coordination of Related Studies

Successful crop production depends on the ability of plants to produce good growth, good yields, and good quality. This in turn requires a knowledge of the essential needs of each kind and variety of crop for best performance. For these reasons, many experiment stations and the Department are carrying on basic studies on the requirements of crop plants for light, water, major mineral nutrient

elements, trace elements, temperature, and other factors. Plant foods, which in various soils become depleted or are locked up in forms unavailable to crop plants and also those substances which may accumulate in excess and upset the normal health of plants, are receiving special attention. Research is also in progress on the influence of the nutritional status of plants on the value of the food products derived from them. This is fundamental to efficient production of crops and their best utilization in human and animal nutrition.

In the long run it is through this basic type of research that the most substantial advances are made. The New York (State) station reports a striking recent example. For several years it has carried on fundamental studies of pectins and the enzymes that act on them. It has observed the disintegrating effect of heat on plant tissues; heat usually causes a partial destruction of the cell structure and softening of the tissues. The pectin research suggested that this disintegrating action might be counteracted by adding minute amounts of calcium. This proved true. Practical application of this knowledge came in the canning of whole tomatoes, which often soften badly in the latter part of the season. The addition of calcium chloride to the can of whole tomatoes forms a gellike compound that supports the tissue even when some of its natural structure has been destroyed. The result is better preservation of the original shape and firmness of the fruit and consequent improvement in its appearance and attractiveness. The principle may be applicable to many other fruit and vegetable products.

Urgent Fundamental Problems

There is no dearth of important problems the solution of which depends upon the investigation of fundamentals. Examples are problems of the plant nematodes and of serious bacterial diseases that damage field crops, fruits, and vegetables. Progress in these fields is retarded by the relatively limited scope of the basic research now possible. The root knot nematode perhaps causes heavier annual losses than such major pests as the cotton boll weevil, grasshoppers, stem rust of wheat, or Texas root rot. It infests greenhouse soils everywhere and fields throughout the South and West; it limits the production of cotton, tobacco, beans, potatoes, tomatoes, and other vegetables, such fruits as peaches, and many ornamental species. Other nematodes attack legume forages, sugar beets, strawberries, and other crops. Work hitherto confined largely to the root-knot species and to a study of practical rotations, and to the development of resistant varieties in a few crops has hardly scratched the surface.

The need for more fundamental research appears in the continued spread of such bacterial maladies as bacterial spot of peach, ring rot wilt of potato, wildfire and blackfire of tobacco, canker and blossom blights of apricots and other stone fruits, soft-rot types, and many others. There is great need for further thorough study of the bacteria involved, their distribution in nature, their genetic variability, their systematic relationships, their hosts, their carriers, their response to

internal and external influences, their physiology, their methods of survival, and other vital relationships in order that clues to effective defense against them may be discovered.

Basic scientific exploration pays because without it many of the most perplexing practical problems must remain unsolved.

FOREST CARE, PLANTING, AND HARVESTING

In the continental United States exclusive of Alaska there are 630 million acres that, though more valuable for forest growth than as plowland, are for the most part vital to American agriculture.

Nearly three-fourths of this land exercises definite influences on our water resources. Neither forests nor dams nor reservoirs can prevent all floods, but protection and management of forest lands and their vegetative cover helps conserve rainfall, prevent erosion, and regulate angry waters. In Mississippi's Yazoo River Valley, for example, protected forest land lost less than 0.5 percent of a 27-inch rainfall that occurred in one 1931 storm, while cleared lands lost 62 percent. In the same storm, cleared land lost 34 tons of its best topsoil per acre, but protected forest land lost none.

This is one reason why national forests, many of which are now located in the East and South, were first created at the headwaters of nearly every major stream and most minor ones west of the Great Plains, for water from partly forested slopes is the lifeblood of irrigated crops that represent an investment of more than $4,500,000 there. In part this is why forestry occupies a high place in the Department's agricultural program.

Protecting Forest-Land Crops

Forest as well as plowland crops require protection from insects, diseases, and fire. Of all forest-tree diseases, white pine blister rust is now doing the most damage. Though the disease has been checked by control measures in Northeastern States, the battle to stop its advance through commercially important stands of western white pine and sugar pine has not yet been won. In cooperation with the Department's Bureau of Entomology and Plant Quarantine, the Forest Service has extended initial treatment for this disease to 2,288,251 acres of Federal lands in the national forests. But there are more than 1,500,000 acres in national forests in parts of five Western States that are still in urgent need of initial treatment.

During 1931–35 western white pine beetles in Oregon and Washington killed nearly as much ponderosa pine as was cut there, and 15 times the quantity destroyed by fire. This was an epidemic. With appropriations available and with the cooperation noted above, areas treated in all national forests because of insect attacks aggregated 624,937 acres last year.

Besides preventive measures, adequate forest-fire protection requires lookout towers, telephone lines, radios, roads, trails, landing fields, tools, supplies, and organized suppression crews.

The national-forest transportation system includes 62,651 miles of road and 118,503 miles of trail now up to satisfactory standards, 42,034 miles of road and 17,690 miles of trail that are substandard, and 32,886 miles of road and 16,647 miles of trail that are as yet nonexistent except on paper. More than 70 airplane landing fields have been constructed, and the total number of lookout towers and shelters now exceeds 3,000.

With these physical improvements, a carefully planned, Nation-wide fire-prevention campaign, and relatively favorable weather conditions, the area burned in the national forests in 1938 was held to 219,000 acres.

The current status and results of cooperative fire protection on the four-hundred-and-seventy-odd million acres of State and privately owned lands needing it may be summarized as follows:

In 1938, 308,458,000 acres were under protection in 40 States and Hawaii. The area burned on protected lands was 2,623,270 acres; the loss was $7,170,630. The total budget was $8,010,553. Of this, $1,736,201 was the Federal contribution; $4,322,011, State; and $1,952,341, private. Through the Civilian Conservation Corps the Federal Government contributed also about $17,000,000 in actual value toward fire-control improvements and the control of fires.

Organized protection should be provided for some 162,000,000 acres which still lack it. Nineteen percent of this area burned over last year, the estimated loss being $34,000,000. Protection should also be intensified on much of the areas already protected.

Hazard Reduction and Timber Salvage in New England

In September 1938 the New England States were hit by a terrific hurricane which left the most dangerous and widespread forest-fire hazard the region has ever known. On large forest tracts and on some 30,000 farm wood lots, it also left some 3 billion feet of down timber perhaps half of which was salvageable.

For generations New England forests have been a source of raw material for industry. Its wood lots have helped their owners to pay taxes, to send their children to school and college, and to provide for old age. Reduction of the fire hazard was essential for the public safety. Timber salvage was vital to the economic welfare of the region.

With more than 900 towns affected, New England appealed to the White House. The President instructed Federal executive departments and agencies to give every possible assistance and authorized the Forest Service to coordinate the work.

The Forest Service immediately set up the New England Forest Emergency Organization, with headquarters in Boston. Its job was to reduce the fire hazard and to salvage timber on a project basis outside the national forests in New England. Hazard-reduction plans were drawn up with the help and approval of State foresters acting for the governors. Decentralized organizations were established in each of six States.

The Works Progress Administration and the Civilian Conservation Corps offered cooperation, and W. P. A. and C. C. C. forces began

work at once. These forces reached a peak of 25,000 men in November 1938. By May 1, 1939, 370 miles of telephone lines for fire protection had been erected, fire hazards had been reduced to normal on some 39,000 acres adjoining heavily used roads, and 5,595 miles of roads and trails had been cleared. Clearing had been done also on 23,000 high-hazard acres around towns and buildings. In cooperation with the Weather Bureau, 44 emergency forecasting stations had also been established, and daily fire-weather warnings were being issued and broadcast.

Hazard reduction and timber salvage within national forests in New England was handled by the forces that normally protect and administer them.

Meanwhile Congress had included in the first deficiency bill an appropriation of $5,500,000 for forest-fire-hazard reduction in New England. Of this amount, $500,000 was for work on the White Mountain National Forest, N. H. The balance was subject to a proviso that money used in any State must be matched dollar for dollar by the State or political subdivision. It became available to the Forest Service, and through it to the States, on April 1. It permitted purchase of badly needed equipment and supplies and made it possible to proceed with establishing twenty-one 50-man camps, plus about 2,500 men in mobile crews to supplement and complement the work of Works Progress Administration and Civilian Conservation Corps crews. Probably at least 2 more years of intensive work will be required in New England before emergency forest-fire hazards there can be reduced to normal.

Timber salvage coordinated with hazard-reduction work in New England is cleared through the Northeastern Timber Salvage Administration, of which the Chief of the Forest Service is Administrator. With offices and facilities in each affected State, this Administration was set up within the framework of the Federal Surplus Commodities Corporation.

Financial Arrangements for Timber Salvage

Federal funds are made available as loans from the Reconstruction Finance Corporation through its subsidiary, the Disaster Loan Corporation. These loans are based on the market value of salvaged forest products delivered at designated points and measured and accepted there by officials of the Northeastern Timber Salvage Administration. Immediate payments are made to owners, under contracts, on a basis of 90 percent of the fair market value of the salvaged material, which then becomes security for the loans. The Administration also agrees to prorate among participating owners such balances as may remain after the completion of the entire salvage job and after all expenses (including the return of the loans with interest at 3 percent thereon) have been paid.

Early estimates indicated that 1.6 billion feet of hurricane-felled timber was merchantable and that 1.4 billion feet might be salvaged if it could be stored in ponds or manufactured before serious deterioration set in. On November 21, 60 days after the hurricane, the

first logs were delivered. By June 30, 1939, with the aid of town committees and cooperating town, State, and Federal authorities, 779 delivery and scaling stations had been established and 11,451 purchase agreements representing 1,520,906,000 board feet of logs and 91,483 cords of pulpwood had been signed. Deliveries to June 30 totaled 474,985,000 board feet in logs and 7,013 cords of pulpwood. Payments to owners or their authorized agents, covering most of these deliveries, totaled $5,165,332. Contracts had also been signed with 274 privately owned sawmills; 238 of them were in operation; and 129,965,000 feet of lumber had been sawed, stacked for drying in storage yards, and invoiced.

Harvesting Forest-Land Crops

Managed on a multiple-purpose basis, forest land may generally be used for two or more purposes simultaneously. Most of our 630 million acres of forest land in the continental United States is grazed by big game. More than half of it is also grazed by domestic livestock.

As grass in cultivated meadows, or as wild grass and weeds and browse growing in combination with timber, forage is renewable. As hay or pasturage, it is harvested annually on well-managed farms and ranches. On national forests it is grazed annually. Range management, with range surveys completed on 70 million acres, aims to limit the number of animals to the annual carrying capacity of the ranges.

Last year the Forest Service issued pay permits to nearly 25,000 farm and other livestock owners to graze more than 1,220,000 cattle, 5,300,000 sheep, 30,000 horses, and 7,000 goats. These domestic animals were restricted to about 60 percent of the federally owned national-forest land. Forage on these lands, plus that reserved for wildlife on the other 40 percent, also provided summer feed for nearly 1,841,000 big-game animals.

Besides big game, national-forest wildlife resources also include some 2,340,000 fur bearers; many game birds such as grouse, quail, and turkey; and fish in about 70,000 miles of trout streams and in thousands of ponds and lakes. This wildlife furnishes valuable annual crops of meat, fish, and fur.

Nearly 32¾ million visits were made last year to the national forests for recreation, which is both a resource and an industry. Returns from forest recreation are higher than from any other resource in Maine, New Hampshire, and New Mexico. They are second only to petroleum in California, to dairying in Wisconsin, and to automobiles in Michigan. Estimates indicate that at least 250 million dollars are spent annually for recreation in communities on and adjacent to national forests.

More than 1,290,000,000 feet, board measure, of commercial timber was harvested on the national forests last year. Such timber can be grown and harvested on about 462,000,000 acres in the continental United States. The Nation-wide inventory and other data gathered by the Forest Service indicate that only about 213,000,000 acres of this

commercial forest land now bear trees of saw-timber sizes; that about 172,000,000 acres are not well enough stocked to yield as heavy crops as they should and now bear trees that are below saw-timber sizes; and that about 77,000,000 acres now have so little forest growth on them that they may fairly be called unproductive.

More than 139 million acres of this commercial forest land is in farm ownership. Each year these farm forests furnish fuel, fence posts, poles, and much of the 6 to 7 billion board feet of lumber used by 6.8 million farm families. Through sales of farm-woodland crops they also annually contribute more than 60 million dollars in cash. Farm forests are a part of American agriculture. Like much of our plowland, however, most farm forests are now run down. To help rebuild and restore them, the Forest Service, in cooperation with the Extension Service and State agricultural colleges, gave assistance last year in approved farm-forestry practices in 40 States and 1 Territory and cooperated with 41 States and 2 Territories in the distribution for planting by farmers of more than 55,000,000 forest trees.

Under current programs, the Agricultural Adjustment Administration has set up standards and provided payments to farmers for (1) planting forest trees and shrubs provided they are protected and cultivated in accordance with approved practices, (2) caring for forest trees and shrubs planted within certain specified years, and (3) more adequately managing existing farm forests. It has set up comparable cooperative arrangements for a naval stores conservation program. Last year this program affected approximately 85 percent of naval stores production.

Through the use of emergency funds, the Forest Service has continued the huge Prairie-Plains tree-planting project within an area in which there are 200,000 farm families. In less than 5 years and with an expenditure of Federal funds that has averaged less than $1,665,000 each year, this project has established more than 11,000 miles of living barriers about 100 feet wide against scorching winds. Nearly 4,100 miles were planted this year. Many of the trees have grown from 4 to 8 feet each year, and some now exceed 35 feet in height. They have reduced soil-moisture losses at critical times, protected cultivated crops, and made the surroundings more attractive. Eventually, through carefully conducted thinning operations, they will provide fence posts, rural telephone poles, and wood for fuel.

Forests and Social and Economic Security

Except for imports, more than 95 percent of the forest products we use and export each year come from privately owned commercial forest land. About 139 million acres of this are farm-owned, but 202 million acres are in industrial and other than farm ownership. Employment in forest industries, in growing forests, in selling and transporting forest products, and in woodworking trades is the main support of many millions of people. Our 462 million acres of commercial forest land are vital to industry and labor as well as to agriculture, to local and national social and economic security, and to rehabilitation.

All of our 77 million acres of idle forest lands are capable of producing commercially valuable forests. Annual growth can be speeded up on the 172 million acres now bearing trees too small for saw timber. These acres and the 213 million acres that bear trees of saw-timber sizes are capable of producing much more than they now do. These and related facts indicate that with an adequate forest policy and action programs we need not have a timber shortage of national proportions. Moreover, forest restoration and improvement of forest stands can provide constructive work for many people. Sustained-yield harvesting can provide social and economic security for thousands of families in hundreds of American communities.

Progress has been made in organizing and operating small forest properties on a cooperative basis. The Otsego Forest Products Cooperative Association, at Cooperstown, N. Y., was developed largely by the Northeastern Forest Experiment Station to determine the best methods of organization for small forest-owner cooperatives. It now manages forest properties for some 300 members, most of whom are farmers. Aided by a loan of $159,000 from the Farm Security Administration this cooperative also manufactures and markets forest products for its members. Cash income of farmers who participate has been increased, and community relief costs have been materially reduced, as a direct result of this association's activities.

Forest surveys involving 21,000 acres in 38 tracts and 30,000 acres in 900 tracts, have been completed in cooperation with the West Virginia Forest Products Association, of Middletown, W. Va., and the Tioga County Woodland Owners Association, of Owego, N. Y., respectively. Extension foresters of these States are drawing up forest-management plans for individual properties there. Extension foresters are now drawing up management plans for forest properties in New Hampshire and Vermont.

The Forest Industries Conference, conceived by the Forest Service and having the following main objectives, has come into existence: (1) To maintain appropriate and effective relationships between forest industries and public agencies having to do with the forest resource; (2) to assure cooperative consideration of business problems common to forest industries and the forest resource; and (3) to insure coordinated handling of such problems by the different agencies directly concerned. It is an advisory rather than a policy-making organization. It has been approved by the National Lumber Manufacturers Association, the American Pulp and Paper Association, and the American Pulpwood Producers Association, and by the Departments of Commerce, Agriculture, and Interior. Present membership in the conference consists of one representative from each of these associations and Departments.

INSECTS AND OTHER PLANT PESTS

Work on insect pests has had prominent place in the Department of Agriculture since early in its organization. It began with research to develop methods by which various important crop pests could be controlled. As knowledge of insects increased, the possi-

bility appeared of modifying farm practices to make conditions less favorable to the pests. Studies were made to determine ways of using parasitic and predacious forms to aid in controlling various pests. It was evident long ago that concerted efforts were necessary to combat the major crop pests, and changing conditions and farm expansion emphasized the need of cooperation.

The widespread occurrence of certain important pests in recent years resulted in the crystallization, by legislative action in 1937, of the policy of cooperation among individual landowners, local agencies, and State and Federal Governments. In controlling these pests the need became evident for widely disseminated information and for the development of means accurately to determine insect-pest conditions in advance, so that outbreaks could be dealt with by concerted action. Hereafter, public funds will undoubtedly be used increasingly to prevent outbreaks, as well as to combat them. This may require basic changes in the provision that Federal aid will be extended in relation to the contribution of the individual and local agencies.

Since 1935 the Department's activities regarding insect pests, both as to research and as to control programs, have been planned and directed by one unit, the Bureau of Entomology and Plant Quarantine. This Bureau also supervises or administers programs to control plant diseases. It conducts research to determine ways of combating insect pests, determines their status, takes action to prevent their introduction into the United States and their spread here; it advises States, local agencies, and individuals of the most effective ways of combating injurious insects and develops ways of utilizing the numerous parasitic and predatory insects to aid in controlling noxious species, and imports and distributes those that are beneficial. In cooperation with States, local agencies, and individuals, the Bureau helps to combat pests such as grasshoppers, the white-fringed beetle, and the pink bollworm of cotton. It advises public land-managing agencies as to the control of certain pests and aids them in planning and directing control programs. While the responsibility rests in such cases with the land-managing agency, the Bureau takes the lead in determining the need for control, indicates approved methods, and aids in planning the control campaigns.

Insect Pests of Cotton

The boll weevil, which first entered the United States in 1892 and in 30 years spread throughout the Cotton Belt, has had a material effect on the agricultural and economic conditions of the South. Its spread into new areas has caused immense economic damage. It is still the most serious pest of our cotton crop and annually reduces the Nation's yield by more than a million bales. However, the cotton growers have become accustomed to it. The use of improved varieties of cotton, and farm practices designed to reduce or offset boll weevil damage have enabled the growers to produce as much cotton per acre as they did before the pest entered the United States. Only when the boll weevil becomes unusually abundant do we hear much about it. Even

under such conditions, research has found a way to reduce the losses. Cotton can now be produced profitably in spite of heavy boll weevil infestations.

By following certain farm practices and using control measures developed through research, the boll weevil can be controlled under various soil and climatic conditions, even where it occurs together with other cotton pests. Farmers in many sections now follow these practices as a matter of course. They also use direct control measures against the boll weevil. In the Cotton Belt as a whole, conditions during recent years have been unfavorable for the boll weevil, but such climatic conditions will not always exist. Years when the pest will again cause serious losses may be expected.

The boll weevil is only one of a number of insects with which the cotton producer has to contend. Several native insects cause extensive losses, and in some seasons attract attention over wide areas. No concerted and extended efforts have been made to protect crops against these pests, but methods of combating them have been developed and may be applied by individual farmers. Nearly every year the cotton-leaf worm, an insect which does not overwinter in the United States, invades large areas of the Cotton Belt by natural means and causes serious crop losses. Large expenditures are necessary for its control.

Another pest now threatens the cotton growers—one more destructive than the boll weevil. No satisfactory control has been developed for it, despite extensive research in various countries. This is the pink bollworm of cotton. It has had limited establishment for some time in sections of the Cotton Belt contiguous to Mexico. On several occasions since 1917 it has become established in limited areas in other parts of the Cotton Belt. Prompt, vigorous, cooperative action has eradicated these infestations. The discovery in 1936 of an infestation of the pink bollworm in the cotton-producing sections of Mexico and Texas in the lower Rio Grande Valley presents a new menace of unusual importance and significance. From this area the pest can spread throughout the Cotton Belt by natural means alone. While our cotton industry has learned to live with the boll weevil, the general establishment of another major pest might lead to far different results.

Should the pink bollworm spread throughout the Cotton Belt, our cotton farmers will have to combat both of the world's most important cotton pests. Our worst pest at present, the boll weevil, does not occur in other cotton-producing countries except Mexico. Our boll weevil losses are somewhat less than the losses of other countries from the pink bollworm. The menace of the pink bollworm has been recognized by the enactment of special legislation which directs the Secretary of Agriculture, in cooperation with the Secretary of State, to confer with officials of the Mexican Government with the object of developing plans designed to eradicate and control it in the United States and in Mexico. No matter what the immediate cost, the development and successful prosecution of such a program should in the long run be of great benefit and profit to both countries.

Japanese Beetle

Since 1916, when the Japanese beetle was discovered in the vicinity of Philadelphia, Pa., the Department of Agriculture has been cooperating with State agencies to retard the spread of this insect into new areas. It lives on a wide variety of plants and spends approximately 9 months in the soil. Because of these habits, an effort to eradicate it is not economically feasible. The measures taken, however, have been effective in retarding, though not in preventing, its spread. From the standpoint of destructiveness, the most important spread into new territory has been by natural means.

The area in which the beetle is now prevalent in large numbers extends to southern New England and westward past the center of Pennsylvania and southward to Maryland and northern Virginia. Losses attract the most attention in the margins of the areas of continuous distribution. Although the pest still causes extensive losses in the older areas of infestation, it attracts less attention there, and it is not so abundant as it was formerly. Control measures have reduced its numbers. Natural enemies of the pest have been introduced and colonized by the Department, and these may be contributing to its reduction. Infestations have been found, however, in localities remote from the area of continuous distribution.

Until comparatively recently it has been the policy to include all outlying sections within the quarantine area, without making an effort to control or suppress the outlying infestations. A different policy is now being followed. The quarantine area is extended only when there is definite reason to believe that larvae are established in the new area, and then only if control measures that may be applied by State and local agencies in cooperation with the Department are not successful in suppressing outlying infestations. This new policy has materially retarded the spread of the insect and has helped to prevent the establishment and rapid build-up of outlying infested centers.

European Corn Borer

Drought conditions which prevailed over many sections of the United States during recent years helped to reduce infestations of the European corn borer. Under the more favorable moisture conditions of the last 3 years, however, the corn borer has spread into new localities.

It is now known to occur as far west as northeastern Illinois and as far south as northeastern North Carolina, where it was discovered for the first time in 1939. In parts of the Great Lakes area, and particularly in New England, New Jersey, and Delaware, it has continued to increase in abundance. The resulting losses this season to sweet corn and other crops by the first generations of the borer were heavier than in preceding years. In some sections as high as 100 percent of the stalks were infested with as many as 20 borers per stalk.

Fortunately, dry weather during the summer interfered with the development of the second generation. Dry weather also retarded an extensive build-up of infestation in the one-generation area south of

the Great Lakes. Nevertheless, this introduced pest is becoming increasingly abundant, and there appears to be no doubt that its importance will become more widespread. In the period during which weather conditions have delayed its increase control measures have been improved and some of its natural enemies established. Methods have been developed whereby it can be economically controlled on crops of high value, such as early market sweet corn.

Grasshoppers

Years of drought have been favorable to the development of grasshoppers and similar pests of cereal and forage crops. Since 1933 grasshoppers have occurred in outbreak numbers over widespread areas in the northern Plains and Western States. The Department has cooperated with State and local agencies in efforts to protect crops. The benefit has been generally recognized. The work, directed solely for the protection of crops, was at first carried out almost entirely on croplands.

In 1938, however, there were large crop losses over considerable areas in eastern Montana, North Dakota, South Dakota, eastern Wyoming, and western Minnesota, into which areas hordes of grasshoppers migrated from range, idle, and abandoned areas. Situations of this nature could not be combated if the cooperative control effort applied to croplands alone. Grasshoppers in range lands far from the more thickly settled cultivated areas cannot be controlled by local action alone. Therefore, in the grasshopper-control program for the 1939 season the Department and cooperating State and local agencies endeavored to control grasshoppers on range, idle, and abandoned land. Grashoppers developed earlier than usual, and large numbers occurred early in June in range areas of the Dakotas and eastern Montana.

Populations of more than 5,000 per square yard were common in many parts of the uncultivated areas along the Missouri River and its tributaries. It was necessary to distribute large quantities of bait under a wide variety of conditions in rough, sparsely settled territory. Thousands of bait-spreading machines were put into operation. This work was augmented by the distribution of bait from airplanes. Grasshoppers were killed by the millions. In a situation that threatened migrations more extensive than those of the preceding year the insects were materially reduced.

The new policy and procedure for Federal and State cooperation in grasshopper control were extended to another area where grasshoppers with migratory tendencies occur. In this area, which comprises large sections of northeastern New Mexico, southeastern Colorado, western Oklahoma, and northwestern Texas, the long-winged migratory grasshopper was occurring in outbreak numbers. Large populations which had developed on range lands threatened crops in this and other sections. Control work on range lands was successful in preventing migrations. There was evidence that widespread infestations of this species in this area had been brought under control. There were no extensive crop losses because of grasshoppers in the current season in any of the 24 States where the cooperative effort was carried on.

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Mormon Crickets

The Mormon cricket, really a wingless form of grasshopper, has also been occurring in outbreak numbers in 11 States in the northern Rocky Mountain area for several years. For the last 3 years the Department has cooperated with the States and counties in control efforts. The program against the Mormon crickets, like the program against grasshoppers, aims primarily at the protection of cultivated crops. The most effective means is to apply control measures while the crickets are young and still banded together not far from the egg beds. Considerable work, therefore, has to be done on land not in cultivation, much of it publicly owned or controlled. The control operations in 1939 reduced these insects so greatly in some sections that extensive control work in these areas may not be necessary in 1940. Elsewhere, however, intensive cooperative work will be required.

Phony Peach Disease

The virus disease of peaches called phony disease, which stunts the tree and makes the fruit of no commercial value, has been known in this country for more than 50 years. By 1929 it had greatly reduced the value of the peach industry in the Southern States, particularly in Georgia. In that year the Department, in cooperation with the States, undertook to suppress the disease and prevent its spread into new areas. A Federal quarantine was promulgated and control work started. Federal operations directed toward the control of this disease have continued since that time. The Federal quarantine was rescinded in 1933, but efforts to retard the spread of the disease continued. The States promulgated quarantines and with the cooperation of the Department developed a uniform enforcement procedure.

The only way to combat this disease is to remove and destroy infected trees. Emergency funds for relief employment provided means to use large numbers of men in this work. Throughout the area where the disease occurred many orchards had been abandoned, and large numbers of escaped and volunteer trees harbored the disease. Between 1936 and 1939 more than 78,000,000 of these trees were located and destroyed. During the same period more than 280,000 infected orchard trees were destroyed. Repeated intensive inspections during the last 3 producing seasons, a period sufficient to assure the development of symptoms, failed to reveal the presence of the disease in 4 lightly infected States and in more than 70 counties in the more heavily infected States. In areas where the disease was more prevalent the number of infected trees has been very greatly reduced. This progress suggests the possibility of eradicating the disease.

White Pine Blister Rust

Since 1916 the Department has been cooperating with State and local agencies to protect white pines from the introduced fungous disease known as white pine blister rust. To complete its development this disease must spend a part of its life cycle on currant and gooseberry plants which commonly grow in association with white

pines. Steps taken to protect white pines from this disease include the eradication of these alternate hosts, millions of which have been eliminated in the vicinity of white pine stands. Large areas of white pine from the East to the West have been protected as a result of this work.

The spores of the disease which infect currants and gooseberries are carried long distances by the wind. Local control, therefore, does not prevent the spread of the disease to new localities. Local protection of pine stands is effective, however, either before or after blister rust reaches the area. During each of the last few years, this rust has been found in new areas in Maryland, Virginia, and the Middle West at short distances beyond previously known infections. In the far West the infection has been found during the last few years in parts of the valuable sugar pine areas of California. Funds provided for emergency relief employment have been made available for use in the removal of currant and gooseberry plants, and as a result the work of protecting pines from this disease has been greatly increased. Much more must be done, however, if the white pine timber of the United States is to be protected, because blister rust is particularly destructive to young stands, large areas of which still remain unprotected.

Dutch Elm Disease

Burled elm logs imported from Europe before 1928 for the manufacture of veneer brought to this country an important virulent disease of one of our most valuable shade trees, the elm. This disease is known as the Dutch elm disease. Infected trees have been found in a number of locations along the route which the logs traveled to factories. In most of these areas, the disease has apparently been eliminated. Repeated inspections have failed to disclose additional infected trees. In the vicinity of New York Harbor, however, the disease has become well established. More than 50,000 affected trees have been discovered and eliminated as a part of an extensive cooperative effort by the Department and State and local agencies. Operations have been under way since 1933.

It has not been possible to scout the area as frequently or as thoroughly as is necessary. During the current season, however, the scouting work has been increased by funds provided through regular appropriations. Preliminary information discloses the presence of infection in new areas at comparatively short distances from the New York Harbor area. Considerable numbers of infected trees have also been found in many localities within that area. The discovery of these infected trees is not surprising or necessarily discouraging. It indicates, however, that the disease cannot be eliminated without continuous and persistent effort.

WEATHER RESEARCH AND WEATHER CONDITIONS

No subject is of more general interest to the people than is the weather. Never before has the meteorologist been pressed so hard for a detailed answer to the question, "What weather can we expect?" It

is not an easy problem, yet much progress has been made. National meteorological services to predict the weather have been organized for only about three-quarters of a century. The method of forecasting from daily weather maps is not as old as the telegraph. Yet today we have fairly accurate weather forecasts for the immediate future, and progress in forecasting methods continues through research activities of the numerous meteorological agencies.

The weather map is the principal tool of the forecaster. Research in weather forecasting seeks to develop new kinds of weather maps which will give a better picture of what goes on in the three dimensional processes of the atmosphere. For example, in order to forecast the weather for the United States it is necessary to have a map of meteorological conditions over North America and the adjacent oceans. In fact, some weather maps represent almost the entire Northern Hemisphere. Moreover, a knowledge of weather conditions at several levels above the earth's surface is essential.

Research in weather forecasting deals with large-scale air movements. At the present time special efforts, under the direction of the Weather Bureau and other interested bureaus and agencies, are pointed toward obtaining a fuller picture of the general circulation of the atmosphere over the United States. It is only in the last few years that sufficient information has been available to construct comprehensive upper-air maps. These maps have shown that summer rainfall is closely related to the location and behavior of a few large, slow-moving eddies in the atmosphere at a height of about 10,000 feet. These eddies are maintained by the converging tongues of dry air from the North and moist air from the South. There is reason to believe that studies of the location, intensity, and movement of these eddies will result in better daily and weekly forecasts of summer rainfall.

In winter, however, the circulation of the atmosphere over the United States is more vigorous than in summer. Our daily upper-air charts reveal the presence of these large eddies in the cold season also, but they move across the country so rapidly then that forecasts a week in advance cannot be made. Therefore, a different approach has been tried. Weekly charts of mean atmospheric pressure have been constructed for the entire Northern Hemisphere. These charts reveal significant displacements of the principal atmospheric "centers of action," such as the Bermuda high pressure area and the Aleutian Low, from one weekly chart to the next, with consequent profound changes in weather conditions over the United States.

These displacements appear to be related to variations of the general circulation of the atmosphere in our latitude. A simple index has been developed to measure the intensity of this circulation. During the winter season it shows fairly systematic variations over 6 or 7 weeks' duration. The explanation of these variations has not yet been found, but their amplitude and apparent regularity give promise in the near future of forecasts covering longer periods.

The Weather of 1939

Following a summer of relatively high temperatures with mostly adequate rainfall, ranging from near normal to decidedly above nor-

mal in nearly all sections of the country, the fall months of 1938 continued abnormally warm. Rainfall was heavy in the Rocky Mountain and Great Basin areas and also in most of the more eastern States, but the Great Plains from North Dakota to Texas were decidedly dry; also, in the South most crops made only fair progress because of the general dryness. At the beginning of the winter the soil moisture was ample over most of the eastern half of the country, except for considerable areas in the South.

The winter of 1938–39 added another relatively warm season in the United States to the frequent mild winters which have occurred during the last quarter of a century. Just when the present predominance of warm years will end and a return to a series of "old-fashioned" winters will begin is not apparent at present. But climatologists confidently believe that no permanent change has occurred in our climate and that an eventual return to colder winters is to be expected. In December 1938 precipitation was scanty throughout nearly the entire country. It was markedly deficient in the Great Plains where the monthly totals ranged from only about 25 percent of normal in Kansas to a little more than half the normal in North Dakota. However, in January precipitation became more abundant, and the winter culminated in one of the wettest Februarys of record. This month broke all previous February records of heavy rainfall in a large part of the Southeast. For the winter as a whole precipitation was above normal in the southern Rocky Mountain States, on the west Gulf coast, and everywhere east of the Mississippi River, Florida excepted.

The spring (March–May) was warmer than normal throughout the country except in a limited area from the upper Great Lakes eastward. March was relatively dry in much of the Midwest, and April decidedly so in the Great Plains, the Rocky Mountain States, and the Pacific Northwest. Because of continued scanty rainfall, severe droughty conditions developed over a large western area by the middle of May. The lack of moisture was intensified by high temperatures, and the need for rain became pronounced from central Kansas and Missouri northward, and northwestward to the Canadian border. However, the latter part of May brought generous and extensive rains to most Midwest sections, which effectively relieved droughty conditions and revived vegetation enormously. However, some sections in the southwest, including most of New Mexico and Arizona, continued unfavorably dry.

The Midwest spring dryness was in marked contrast to the spring of 1938 when rains were heavy over most of the country. There was less rainfall during the spring months of 1939 than in the spring of 1936, a severe drought year, in Colorado, New Mexico, Texas, Kansas, Nebraska, South Dakota, and Minnesota, but in other Midwest States there was somewhat more moisture than in the spring of 1936.

June had abundant rains except in the Southwest where a considerable area continued dry, including principally Colorado, New Mexico, and Arizona. In an area between the Mississippi River and the Rocky Mountains the June rainfall was timely, substantial, and

very beneficial to growing crops. The amounts were especially abundant in the northern Great Plains, Montana receiving nearly one and one-half times the normal. Temperatures continued to range generally above normal.

Drought in Northeast States

In July 1939 a serious drought developed in the Northeastern States, unfavorably affecting an area from New Jersey and Pennsylvania northeastward. Some sections had the greatest July rainfall deficiency in half a century up to nearly the close of the month when there were intermittent showers on several days. However, these were decidedly local in character and irregular in amount, in some cases being heavy and in others not enough to be of material benefit. Early in August additional rains occurred over most of the northeastern area. However, an urgent need for rain continued over a large southwestern section and also throughout the Great Plains from North Dakota to the Rio Grande. Most other interior States had sufficient moisture for current crop needs.

During the last half of August 1939 one of the most widespread and severe fall droughts ever recorded in this country began. Absence of material rainfall was accompanied by abnormally high temperatures. These conditions were, of course, very unfavorable for agriculture, especially for fall seeding. Throughout the western Winter Wheat Belt the subsoil became very dry. In large areas the topsoil was so dry that farmers had to defer their seeding in many places. Much dry-seeded wheat did not germinate.

In the interior States between the Appalachian and the Rocky Mountains there was very little rainfall in September until near the end of the month, when widely distributed beneficial showers fell. Early in October many sections had additional moisture, which was particularly helpful in the central and western Winter Wheat Belt. Much dry-seeded wheat germinated, and seeding was greatly facilitated. However, these rains provided only temporary relief.

Extreme dryness again set in, the drought extending into the Southeastern States, where rainfall had previously been sufficient. October had very little moisture until near the close of the month, when substantial to heavy rains fell in most localities in the lower Great Lakes area, the central Mississippi and Ohio Valleys, and the Appalachian Mountains. No appreciable rainfall occurred over the Great Plains States, however, and extremely droughty conditions continued in that area.

RURAL ELECTRIFICATION

The Rural Electrification Administration makes a significant contribution to the improvement of farm living and farm operations. Created as an emergency agency in May 1935, the Rural Electrification Administration was charged with a 10-year program of farm electrification under the terms of the Rural Electrification Act of 1936. For a little over 4 years it operated as an independent establishment; then, on July 1, 1939, as a result of President Roosevelt's Reorganization

Plan II, it became a part of the Department. This transfer emphasized the agricultural aspects of the rural electrification program and moved toward an even closer correlation with other departmental objectives.

The problem of improving conditions of farm living and farm operations has been fundamental in many of its activities. A special aspect of this problem, up to 1935, was the farmer's inability to avail himself of the advantages of electric power, so long enjoyed by his city brethren. At the beginning of 1935, only 10 percent of American farms had central-station electricity, while more than 6,000,000 farms were unelectrified. Partly as a result of connections to Rural Electrification Administration financed lines and partly as a result of accelerated activity by private companies, the number of electrified farms had increased to well over 1,500,000, or about 22 percent of the total, by July 1, 1939. New connections during the second half of the calendar year 1939 are expected to make a sizable increase in the number of farms served.

Thus the rural electrification program has made giant strides in 4 short years. Up to September 15, 1939, the Rural Electrification Administration had lent or allotted $249,708,793. The greater part of this sum is going directly into the construction of new electric lines to serve farmers who have hitherto lacked the benefits of electricity. The truly national character of the program is indicated by the fact that projects financed by the Rural Electrification Administration, which in mid-September numbered 657, covered parts of 44 of the 48 States. Embracing some 240,000 miles of rural lines, these projects are designed to serve between 600,000 and 700,000 farm families.

As the lines have been built and put into operation, the construction of other rural lines by utilities, which in many sections of the country was virtually at a standstill in 1935, has gone forward rapidly. For some time the utility construction exceeded that of the Rural Electrification Administration projects. Although this condition has been reversed, active construction by the utilities continues. Since it must be assumed that utilities expect these new lines to be profitable, their extensive rural activity provides one of the most compelling evidences of the feasibility and soundness of wider rural electric service.

Uses of Farm Electrification

The rural-electrification program proposes not merely to make electricity available to as many American farms as possible, but also to make it available on terms that encourage full use so as to affect farm life significantly. Surveys taken in numerous States where projects have been in operation for several months give concrete evidence of the improved standards which electricity brings. In the farm home the use of such electrical appliances as washing machines, running-water systems, vacuum cleaners, and refrigerators are contributing greatly to the health and comfort of the farm family and are relieving the housewife of the intolerable burden of household drudgery. Much more important, perhaps, in the long run, is the introduction of electricity in farm operations. In poultry farming, in dairying, and in many other activities, it has been demonstrated already that electricity

is an invaluable servant, that skillfully used it can earn sufficient income to pay its own way, and that often its use can be made a source of added profit for the farmer.

But the implications of rural electric service do not stop with the lightening of farm work. The program likewise enhances the welfare of the young people on the farm, and in so doing provides a notable implement for stabilizing farm population. During their school days, farm children may have the advantages of proper light to make school work easier and eyestrain less threatening, of better school sanitation, of electric cookery for hot lunches, and of improved and amplified equipment, particularly in domestic and manual-training courses, which have such great practical value. Radio offers a source of instruction and amusement that should go far toward maintaining or restoring the farm home as a social unit.

The modernization of farms and farm homes is in itself a powerful stabilizer. From numerous areas reports have been received that the construction of the electric line financed by the Rural Electrification Administration has been promptly followed not only by the installation of modern bathrooms, as well as electrical appliances, but also by remodeling, repainting, and refencing. By helping to close the gap between rural and urban living, electric power can do much to retard the undesirable migration of rural people. The eventual result of such stabilization is, of course, healthier rural communities—communities in which essential services such as schools, roads, bridges, churches, and mails can be more easily justified on an economic basis.

Benefits to Low-Income Groups

Another departmental objective toward which the Rural Electrification Administration promises to contribute may be stated broadly as improving the lot of the underprivileged. From the outset it has required that in a given area all farmers who can be served economically shall be served—not merely a selected group of the more favored and prosperous. This area-service principle has done much to bring modern conveniences and opportunities to farmers of limited means. The Rural Electrification Administration expects to carry this principle a long step further through its recently devised plan for low-cost service within the means and reach of many tenant farmers and sharecroppers whom rural electrification has heretofore passed by.

The Department stresses the need for establishing democratic methods of translating departmental programs into farmer activities. Though conducted independently for several years, the Rural Electrification Administration has consistently fostered the American ideal of democratic control. Nearly 90 percent of its borrowers are organized as electric-service cooperatives. This form of organization means that every member, at least potentially, has an equal responsibility for the conduct of the organization and an equal voice in the control of management and operations. In those rare cases where the Rural Electrification Administration has learned that individuals or small groups were attempting to run the cooperative for selfish purposes, it has moved promptly and forcefully to help the members regain the

direction of their own affairs. By emphasizing the need for local leadership and conscientious participation in community affairs, the Rural Electrification Administration is helping to validate our ideals of political democracy in the social and economic spheres.

The idea that the farmers of this country are entitled to rural electrification has gained wide acceptance in the few years since the Rural Electrification Administration was set up. During those 4½ years electric service has been made available through Federal efforts and by the utilities to more farm people than in the three decades since rural electrification had its beginnings in the United States early in the century. But too many farms are still denied the benefits of twentieth century electricity and power. The United States still has 5,200,000 unelectrified farms. In meeting the challenge of carrying electricity to more and more farm families, the Rural Electrification Administration is helping to establish a sounder and more prosperous agriculture.

WIDENING USE OF HOME ECONOMICS

More effective use of foods, textiles, and other agricultural products, and higher levels of living for farm families through improved use of their resources are objects of research in the Bureau of Home Economics. Specific goals include: More adequate diets for the Nation's families; improved housing, based on knowledge of how the dwelling can promote wholesome family life; better use of income and increased satisfaction through more widespread understanding of household buying problems; and greater security for families through wise management of family finances.

Because of the close relationship between food-consumption habits and health, agriculture's food-production program should promote better human nutrition. Studies in the Bureau of Home Economics help to determine what people need in terms of essential nutrients (such as proteins, vitamins, and minerals) and how much of each; what foods will provide these essentials in adequate amounts; what foods people commonly use and in what quantities; whether customary diets are adequate from the standpoint of nutritional needs; and how people may be helped to improved their patterns of food consumption. Agricultural production practices and conditions affect the quality and the composition of foods. Therefore, the Bureau investigates the many and varied factors that influence the nutritive properties and the quality of food. It works to develop new uses of food products, better methods of food preservation, and improvements in household practices of cooking foods.

Research is under way with regard to means of increasing consumer satisfaction from the use of cotton and wool garments. A special study this year dealt with ways of manufacturing cotton hose so that they may have greater elasticity and better finish and style. Other research helps homemakers to buy the clothing and household textiles that best suit their families' needs, tastes, and incomes. In order that mothers may more readily obtain garments that fit their children, the Bureau has measured 147,000 children between the ages of 4 and 17. The findings should serve as a better basis for standard sizes of garments.

Studies of the qualities of cotton and wool fibers that make for serviceability in sheets and blankets have revealed information of high practical value. Factors in the construction of fabrics, such as thread count, weight, and strength, affect their durability, and the findings of research in this field can be of great aid to the household buyer. They should be useful also to manufacturers in establishing minimum standards of quality and market grades for consumer goods, and in furnishing informative labels. In helping to provide such buying guides, the Bureau works with other agencies interested in consumers' standards, such as the American Standards Association and the American Society for Testing Materials.

Studies of Housing Needs

Housing needs of families have been less studied. Considerable work, however, has been done in this field. Surveys have been made as to the size of farmhouses, their state of repair, the number of unused rooms, the number of persons per room, and the proportion of families at different income levels whose dwellings have such modern facilities as running water, electric lights, and central heating. Information has been summarized on what farm homemakers want in the way of improved living quarters, in improved types of house, in the arrangement of work centers, and in storage space. There is need for research as to how houses may function more adequately; how they may better contribute to comfort and happiness; what are the most effective uses of housing space when construction costs are high; and as to what size and shape of rooms best suit varied family activities. A study of farm kitchens, now under way, is of this type; its purpose is to determine how much space is needed for the tasks commonly carried on by the farm family in the kitchen, and what arrangement of work spaces and of equipment will best facilitate these tasks.

Associated wtih problems of housing are those of household equipment, which greatly influences the efficiency of homemaking, the time and energy spent in household tasks, and the family's comfort and well-being. Equipment available for their preparation affects the character of meals. Labor-saving devices save strength and health when the homemaker has heavy responsibilities for laundry work, canning, and other types of household production. In purchasing her household equipment she needs buying guides. Research in home economics helps to establish standards for household equipment and also helps homemakers to use equipment more efficiently.

Use of Family Incomes

The level of living a family can achieve is limited by its income. However, family incomes are not inflexible in the satisfactions they may provide. Through budgeting, production for family use, and other wise practices, family funds go farther than if spent in hit-or-miss ways. As a basis for the management of family cash incomes and other resources, the Bureau studies family consumption, and the kinds and quantities of goods and services used, both purchased

and home produced. Besides serving as guides to the individual family, the information thus obtained influences present and potential markets for products of both agriculture and industry. It is widely used by manufacturers.

Consumption studies show that the diets of many of the families in this country are inadequate. The main factors are the inadequacy of many family incomes and poor choice of foods. The Bureau and other agencies in the Department are using facts from dietary studies in educational programs designed to help families select foods more wisely. Improved food habits, besides benefiting the national health, also call for increased use of such agricultural products as vegetables, fruits, and dairy products, especially milk.

Careful land use planning by the individual farm family often enables the family to produce a considerable share of its food supply and thus to improve its diet greatly. By saving on grocery bills, the family can spend more for other items of living. Research in home economics has provided the basis of improved plans for family food production. These plans are being used in the educational programs of the Extension Service and the Farm Security Administration.

Studies of family income and consumption have an important bearing also on agricultural policies designed to decrease farm tenancy and to increase the ownership of farms by the operating occupants. All too often in the past families have been unable to carry out plans for land purchase because the plans did not provide for meeting both living expenses and payments on the loan. Unless the family can have a decent living while a mortgage is being amortized, the family members are likely to become discouraged and leave the land. Studies of family consumption by income levels provide information of fundamental importance in all agricultural planning. This information is valuable also to other governmental agencies, and to social and business groups whose policies and programs are concerned with the adequacy of family incomes, with the financial security of urban and rural families, with the family use of credit, with the ability of families to buy goods and services, and with their market preferences as shown by their buying habits.

THE FOOD, DRUG, AND COSMETIC ACT

The new Food, Drug, and Cosmetic Act affects the national standard of living in both town and country. The farmer, however, receives a twofold benefit from the enforcement of this statute. As a consumer he shares with the city dweller the protection afforded by the law against contamination, debasement, and misrepresentation. As a producer he has assurance that the products of his industry which must be processed before they are consumed will reach the consumer in an unadulterated and acceptable form.

Food products that reach the market in the raw state are seldom subject to adulteration. Most foods, however, pass through some form of processing or manufacturing before they reach the consumer. If they undergo adulteration in the course of their journey from the

farmer to the consumer the farmer suffers in various ways. Adulteration of natural agricultural products with substitutes reduces the demand for the farmer's products. Consumer distaste caused by the marketing of lower-grade products further reduces the demand. The farmer's burden is increased still more if he is obliged to buy back the manufactured product of the farm after its quality has been impaired by adulteration.

Maintenance of high standards in food and drug manufacture, as required by the Food, Drug, and Cosmetic Act, is an essential part of the whole job of producing high-quality farm products. The law assures the farmer that the good-quality products he has raised will not be debased on their way from the farm to the consumer's table. It protects his livestock against worthless veterinary preparations and thereby prevents serious losses. In recent years interstate commerce in medicinal products falsely and fraudulently labeled as having therapeutic value in contagious abortion of cattle, in hog cholera, in tuberculosis of livestock, and many other serious stock diseases has become practically nonexistent through the enforcement of the law.

It is logical that the Department of Agriculture should be charged with the enforcement of the new Food, Drug, and Cosmetic Act approved on June 25, 1938, as it was with the administration of the older law, the Food and Drugs Act of June 30, 1906. The food supply and to some extent the drug supply are largely products of agriculture. Moreover, the Department gathers comprehensive information on food production, food composition, and food processing, which is available to the enforcement officials and is invaluable as a guide in enforcement operations.

Three of the provisions of the new Food, Drug, and Cosmetic Act, all of them vitally important to the public health, became effective at once. These were: (1) The requirement, growing out of the fatal elixir sulfanilamide episode of 1937, that no new drug be introduced in interstate traffic unless an application filed with the Secretary of Agriculture establishes that it is safe for use; (2) the ban on drugs and devices, dangerous to health when used in the dosage, or with the frequency or duration prescribed, recommended, or suggested in the labeling; and (3) the prohibition on traffic in dangerous cosmetics.

The Food and Drug Administration took immediate steps to effectuate these provisions of the law. Within 3 weeks after the passage of the act it completed necessary preliminaries by locating interstate shipments, and collecting and analyzing samples. Thereupon seizures were directed against eyelash dyes containing the sight-destroying coal-tar color, paraphenylenediamine. Every consignment of this type of dye which could be found was seized, and criminal prosecutions were instituted. Other dangerous types of cosmetics proceeded against in the course of the year included skin bleaches containing mercury compounds, and lipsticks containing the toxic metals, cadmium and selenium. Similar actions were directed against drugs and devices dangerous to the user when employed in accordance with label directions. A total of 166 legal actions were instituted under the new law during the year.

Between June 25, 1938, and June 30, 1939, 1,277 applications covering new medicinal products were received and reviewed by the Food and Drug Administration to determine whether the drugs were safe for use. Of the 1,107 applications reviewed before the end of the year, 683 were made effective under the act, 376 were held in a pending status awaiting further information from the applicants, and 48 were withdrawn by the applicants.

The statute, in addition to making effective its new public health safeguards, authorized the Department to proceed with the formulation of the many regulations required. This entailed time-consuming hearings in which members of the Food and Drug Administration, the Solicitor's Office, and representatives of the food, drug, and cosmetic industries and the public participated. Many of the most essential regulations have now been promulgated. The preliminary steps in the formulation of definitions and standards for food products have also been taken. In the hearings on food standards the cooperation of consumer representatives who made known consumer views was invaluable. The act is designed as a consumer statute, and its purpose will not be served if it does not guarantee the consumer honestly labeled and honestly manufactured foods and drugs.

A commendable spirit has been manifested by the industries in meeting the new requirements. For the most part earnest efforts were made to complete required label revisions before June 25, 1939, when the new law was to become fully effective. Toward the end of the year, however, a movement began, actuated undoubtedly in part by an honest fear that insufficient time remained to complete label revisions before the dead line and in part by a spirit of procrastination, for postponement of the new labeling requirements by legislative amendment. The effort was successful; for an amendment, approved June 23, 1939, extends the effective date of the labeling requirements to January 1, 1940, with limited provisions authorizing the Secretary in specified cases to grant a further postponement until July 1, 1940. Consumers to some extent, therefore, will be denied for a time the fully informative labeling called for by the act. Meanwhile, however, numerous manufacturers have wisely determined to meet all new labeling requirements immediately. Consumers who seriously desire to acquire the full benefits of this new statute will develop the habit of intelligent label reading of foods and drugs. When the law becomes fully effective, labels will reveal much valuable information which heretofore has been denied the buyer and which should facilitate wise selection and use.

HENRY A. WALLACE,
Secretary of Agriculture.

G–96 Issued November 1939

AGRICULTURAL ADJUSTMENT 1938–39

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A Report of the Activities Carried on by the Agricultural Adjustment Administration July 1, 1938, Through June 30, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL ADJUSTMENT ADMINISTRATION

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AGRICULTURAL ADJUSTMENT 1938–39

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A Report of the Activities Carried on by the Agricultural Adjustment Administration

Under the Provisions of the Agricultural Adjustment Act of 1938, the Soil Conservation and Domestic Allotment Act, and Related Legislation, from July 1, 1938, through June 30, 1939

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LETTER OF TRANSMITTAL

United States Department of Agriculture,
Agricultural Adjustment Administration,
Washington, D. C., November 1, 1939.

Hon. Henry A. Wallace,
Secretary of Agriculture.

Dear Mr. Secretary: Herewith is transmitted the sixth report of the Agricultural Adjustment Administration, covering its activities during the year July 1, 1938 through June 30, 1939, during which period the 1938 program was carried out in accordance with provisions of the Agricultural Adjustment Act of 1938, the Soil Conservation and Domestic Allotment Act, and related legislation.

Some of the activities covered in previous reports of this agency, which were transferred to other agencies in the Department of Agriculture by the departmental reorganization in October of 1938, are omitted from this report. These relate to marketing agreements, surplus removal, administration of sugar-quota legislation, and program planning.

Sincerely yours,

Administrator.

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Agricultural Adjustment 1938-39

CHAPTER 1

FOREWORD

It is now more than 6 years since the enactment of the first Agricultural Adjustment Act. During these 6 years the Agricultural Adjustment Administration has faced a variety of emergency problems. These have successively included surpluses, drought, the recasting of the farm program after the Supreme Court decision of 1936, the accumulation of new surpluses under the 1936 and 1937 programs, the administration of new legislation in 1938, and finally today, the overshadowing fact of war in Europe.

Out of these emergencies and out of the long-time needs of agriculture has evolved the present comprehensive national agricultural policy in which the program of the Agricultural Adjustment Administration has been and continues to be an integral part. With this program farmers are prepared better than ever before for the difficult problems of adjustment that must inevitably follow war abroad.

While emergency situations command wide public attention, it is important to remember that there are certain fundamental relationships between agriculture and the rest of our economy which exist at all times. For our continuing welfare the proper maintenance of these relationships is essential. The following pages review these relationships and the responsibilities of the Agricultural Adjustment Administration in properly maintaining them.

The Agricultural Adjustment Administration seeks to help the farmer help himself. Its help is not limited to the farmer. No farmer lives unto himself alone. How he uses soil resources, how much he produces, how much he buys, how living standards are maintained on his farm—all these vitally concern businessmen, industrial employees, consumers, and others.

The Agricultural Adjustment Administration was set up and operates in recognition of the fact that the whole Nation fares pretty much as farmers fare, just as farm welfare depends upon National welfare. Rural economic sickness is highly contagious.

The job of keeping agriculture economically sound and healthy is primarily the farmers' job. To help farmers do that job, the farm program provides a governmental agency through which farmers can tackle the job unitedly. The Government assists farmers in conserving the soil and increasing farm cash income. This is a contribution to the welfare of all groups in the Nation.

I. THE NATIONAL STAKE IN FARM WELFARE

It is a function and an obligation of agriculture to supply the farm and urban population with food and fiber. More than 130 million people are dependent upon nearly 7 million farms for the bulk of their food products, for the bulk of their clothing, and for much of the raw material which, when converted into finished products, makes up the conveniences and comforts of living. Agricultural products that provide the essentials to living are and should be supplied abundantly, and it is important that they be supplied at fair prices.

But food and fiber are not the only contributions which the farm makes to the Nation. Cities do not live by bread alone, nor is bread all that they require of the farm. Farms are expected to provide profitable employment for a large part of the population. Farms are expected to provide customers for business. Farmers are expected to preserve the soil, which is one of the Nation's chief assets. Farms are expected to rear and educate a relatively large share of the country's youth. These are the farm's best contributions. When farms cannot make these contributions adequately, the whole country suffers.

THE FARM'S CONTRIBUTION TO BUSINESS

About one-fourth of the actual or potential customers of American business live on farms. The amount of products that these people can buy depends directly on how much farm income they have. During the depression the farmers' share of the national income fell as low as one-sixteenth of the total. This meant that one-fourth of the Nation's consumers had so little purchasing power that they could not function adequately as customers. Besides this fourth that live on farms, many others who live in towns, which are centers of farming communities, depend on farm income for their livelihood nearly as much as do farmers themselves. Altogether, those living on farms and in rural towns constitute 40 percent or more of the entire population. They represent a tremendous potential outlet for retail trade, which becomes an actual outlet only when the ability to buy is added to the ability to consume.

The wheel of commerce and industry is geared to the farmer's dollar, and it turns less rapidly when the farmer's dollar is reduced in size. Business looks to agriculture to supply purchasing power so that sales can be made and maintained in rural areas. Supplying this purchasing power is the farm's contribution to business. This relationship was recognized by Congress in the agricultural adjustment acts.

THE FARM'S CONTRIBUTION TO URBAN JOBS

Another important service of agriculture is to provide employment for a large section of the Nation's workers. Nearly 11 million persons are gainfully employed on the farm. When farm returns are not lucrative as compared with work in cities, the tendency is for farmers and farm labor to seek a better livelihood in urban areas, where they compete with city workers for jobs. In the long run, low-priced food products do not benefit a city worker if they bring more farmers and farm laborers into town to compete for his job.

Then, too, a farmer with income helps make urban jobs by buying the products of industry. Increasing farm income has been an important factor in reemployment. Farm dollars soon become pay-roll dollars. A close connection exists between city pay rolls and farm income. They rise and fall together.

FARMERS ARE GUARDIANS OF NATION'S SOIL

Soil resources are the Nation's chief asset. The wealth of the country is based largely upon the soil. Only recently have we as a Nation come to regard soil fertility as an asset that can be worn out or lost through erosion and overcropping.

Food and raw materials for clothing have been cheap in this country if one considers only the price that farmers received for them. But the cost to the American people was more than the current price of the product. Under pressure of low prices for their products, farmers and their families were forced to mine their soil in order to stay in business. Prices were too low to enable the farmers to replace soil fertility. Individuals paid current prices for food and fiber, but the American Nation as a whole is paying a tremendous cost in the loss of soil resources. Much of that loss can never be recovered.

Soil exploitation has contributed heavily to damage that has been done to some 100 million acres of farm land already ruined or so seriously impoverished that it no longer can be profitably farmed. It has been estimated that soil erosion continued at the present rate would mean a loss of from 20 to 30 billion dollars during the next 50 years.

In the long run, the cost of food and fiber is based upon soil fertility. Despite heavy soil losses, farms in this country still can produce more than we need. But that should not disguise the danger that lies ahead if soil depletion and soil erosion are permitted to continue unchecked. We cannot continue indefinitely to use up good land to yield products that farmers sell below production costs. Low farm prices are potent causes of soil damage.

About half of the land area in this country is in farms, which include most of the fertile soil. Soil conservation is gradually becoming a basic part of farming. Farm income should be adequate to enable the farmer to put back into the soil the plant nutrients that his crops take out of it, just as a manufacturer sets up reserves for depreciation of plant and equipment. Only with adequate income can the farmer discharge his responsibility as guardian of the soil.

THE FARM'S CONTRIBUTION TO REARING YOUTH

Until recently we have been prone to disregard the extent to which the American farm maintains our National birthrate. The birthrate in rural areas is considerably higher than in the cities. In cities of 100,000 or more, for instance, 10 adults are now rearing only 7 children. Among the farm population, on the other hand, 10 adults are rearing 14 children. In other words, the civic and financial burden of rearing and educating children is about twice as heavy on the farm as it is in the city. Furthermore, the farm has paid much of the cost of educating adults now living in cities. In the decade 1920–29 about 40 percent of the youth who started to work in urban offices, factories, and

stores, came from farms. During their youth they were fed, clothed, and educated out of farm income. The burden on the farm of rearing and educating this proportion of our youth points to the need for an adequate farm income for the maintenance of rural educational standards, and of satisfactory health and social conditions.

THE PLACE OF THE FAMILY-SIZED FARM

It was against the background of farm life that much of what is richest in flavor and most definite in character in our American tradition developed. And the central point in that background was the family-sized, family-owned farm. It is among this country's oldest institutions. In this environment our political and economic concepts were shaped to a great degree. At the present time, when social change has done much to cause disintegration elsewhere, the security of the family-farm is being threatened.

The grouping of large numbers of small farms into large-scale holdings has spread at an alarming rate. The National Resources Board has predicted that, unless checked, this process, under the stimulus of increased use of farm machinery, which makes it possible with a large capital investment to put products on the market more cheaply, is likely to be accelerated.

The Board predicts that there will be fewer farmers supplying the commercial market for farm products, and that more small farmers will be forced to seek employment in cities or, failing that, to eke out a livelihood on subsistence farms.

For a time, large-scale farming may be able to supply cities with cheaper farm products. If that were all to be expected from farms, there would be no occasion for alarm. But the development of large-scale farming would provide employment for a smaller share of the population; and it would supply business with fewer customers. Likewise, under increased tenancy, the country could not expect soil resources to be guarded as well as they would be under wider owner management. Farmers themselves are apparently becoming deeply conscious of the extent to which the growing use of power machinery is favoring the development of large-scale farming. Crop reporters have commented more extensively than ever on the displacement of population by the consolidation of farms into larger holdings for operation by power machinery. They report numerous cases in which farm buildings have been moved away or torn down; or cases in which farmers have stopped farming, many selling out at sacrifice prices; or cases, finally, in which displaced farmers have gone to nearby villages, where they have often been added to relief rolls.

Until the agricultural adjustment acts were put into effect, there was little to protect small farmers from the competition of large-scale farm operations although Federal legislation has long sought to protect small businessmen from monopolies. The Agricultural Adjustment Administration program, through its acreage allotments, guarantees the farmer who participates in it a fair share of the market, and at a price better than that which ordinary competition would allow him. The program is especially liberal to small farmers, and affords price-income and soil protection without which solutions to these problems would be much more difficult.

FARM MUST HAVE INCOME TO MAKE FULL CONTRIBUTION

An adequate farm income is necessary if agriculture is to continue to make its important contributions to the country. Unless income is adequate, we cannot expect farmers to be good customers. Unless farm income is adequate we must expect that unemployed farmers will go to cities to compete with urban workers for jobs. Unless farm prices are fair, farmers will be driven to soil exploitation. Unless farm income is adequate, we cannot expect the farm to continue to provide decent standards of living for boys and girls on farms. We can no longer expect that all these farm services will be provided when corn is 12 cents a bushel, wheat 35 cents a bushel, and cotton 5 cents a pound, and prices of other products are at equally low levels. Not much more than food and fiber can be expected from long-continued unprofitable farming. But from profitable balanced conservation farming we can expect a much wider range of services.

A. A. A. CONTRIBUTION TO FARM WELFARE

This report is an account of the Agricultural Adjustment Administration's stewardship in 1938. That year marked an important phase in its progress. Behind 1938 lie the years in which the program was being formulated and strengthened. Ahead lies its further development.

How well did agriculture function during 1938, and what did the A. A. A. do to improve its functioning? Did it provide adequate supplies of food and fiber? Did the A. A. A. improve the assurances of adequate supplies? Was farm income adequate to enable the farmer to adopt a better living standard, to enable him to care for his soil, to speed up the wheels of business and commerce, to provide a return for farm labor commensurate with American standards?

The objectives of the Agricultural Adjustment Administration are threefold:

1. Abundant production of farm products adequate for all domestic requirements, for available export markets, and for an ample reserve.
2. Conservation of the soil through wise use of land by acreage allotments and by increasing soil fertility through soil-building practices carried out by all participating farmers.
3. A fair share of the national income to farmers through improvement of prices by better balanced supplies and by conservation and parity payments.

In achieving these objectives the A. A. A. relies upon the State, county, and community committees which form a decentralized democratic mechanism for administration of the program.

II. SUPPLIES OF FOOD AND FIBER

The Agricultural Adjustment Act of 1938 provides that its operation shall not prevent and shall help American farms to produce adequate supplies of food and fiber. Did agriculture produce enough in 1938? For purpose of comparison, figures for the 6-year period from 1924 through 1929 serve as a convenient measure. While it is

true that the American population is now larger, it is also true that export markets have shrunk, and part of what was formerly exported is now available for home consumption.

Farm production in 1938 was 4 percent larger than the average for this 6-year period. Dairy production was about one-sixth larger; production of truck crops, fruits, and vegetables about one-fourth larger; and grain production about 2 percent larger. The output of the farm was less than in 1937, but the reduction in cotton output accounted for most of the decrease.

FARM OUTPUT ABOVE INDUSTRY'S LEVEL

The index of farm production has remained consistently higher than that of industrial production throughout the present decade. Even during the drought years, when a large part of the farm land that normally produces much of our food supply was barren, there was only one year in which total farm production was lower relative to the 1924–29 average than industrial output.

The consistency with which agriculture has maintained its production at a relatively higher level, compared with pre-depression standards, than that maintained by industry, is shown in the following tabulation:

Year	Industrial production (1924–29=100)	Agricultural production (1924–29=100)	Year	Industrial production (1924–29=100)	Agricultural production (1924–29=100)
1930	90	101	1935	84	92
1931	76	107	1936	98	95
1932	60	100	1937	103	109
1933	71	97	1938	80	104
1934	74	94			

AMERICAN FARMER HAS AMERICAN MARKET

American farms supply the great bulk of the American market. Of the home market for products that are produced in this country, the American farmer supplies more than nine-tenths. There has been little change in this situation in the last 15 years. In 1938 American producers supplied at least 99 percent of the American market for dairy products, for pork, and for corn, and more than 95 percent of the market for beef. These products are mentioned because they bulk large in the list of competitive farm imports, but imports of them are small when compared with the total products that the home market takes. Furthermore, this country normally exports more farm products than it imports.

Imports supply deficiencies on the market when there is crop failure. For example, when the drought cut the supplies of corn to nearly half the normal production, supplies of corn from Argentina and Mexico helped American farmers carry their livestock through. However, even with the drastic curtailment of corn production during the drought, imports of corn in the heaviest year of imports accounted for only about 4 percent of a normal corn crop. Corn imports were negligible for the 1938 season, amounting to less than one-tenth of

1 percent of our total corn production. In times of scarcity, imports may be of benefit to consumers and producers of livestock products alike. As a rule, competitive imports increase when the American market is good, with prices high enough to warrant bringing in agricultural products over the tariff barriers.

THE EVER-NORMAL GRANARY

The Ever-Normal Granary has grown out of the experience of farmers in the last 6 years. In the Ever-Normal Granary farmers carry over food and feedstuffs from years of plenty into years when they are needed to provide an adequate supply.

During the drought of 1934, corn stored on farms under the first corn loan in 1933 helped piece out feed supplies for our livestock. Now a loan and storage program under the Ever-Normal Granary plan is in effect for wheat, which is the No. 1 food crop, and for corn, which is the No. 1 feed crop. Additional wheat reserves are held in the Ever-Normal Granary through Federal crop insurance, under which program wheat growers put aside a portion of their crops as premiums to offset possible crop failure. The insurance reserve is in actual wheat on which insured farmers may draw when they have crop losses.

The Ever-Normal Granary makes larger carry-overs possible. By storing corn, we are carrying over in a nonperishable form potential supplies of pork, beef, dairy products, eggs, and other animal products.

The Ever-Normal Granary means more than storage of surplus supplies. Farmers are building up an Ever-Normal Granary in soil fertility. Maintaining a fertile soil is the best means of assuring consumers future supplies of food and fiber at reasonable prices.

Almost 6,000,000 farmers working through the A. A. A. programs are maintaining production at an adequate level, and, at the same time, maintaining in their land ample supplies of soil fertility, which is the fountainhead of the flow of farm products to market.

III. CONSERVATION OF THE SOIL

In the long run, a profitable agriculture depends upon a fertile soil. Programs of the Agricultural Adjustment Administration conserve and build soil fertility. The shift from intensive cropping gives rest to millions of acres that for years have been hard driven by surplus production. Cover crops that produce feed for livestock are serving the additional purpose of keeping fertility in the soil instead of letting it drain away through a course that begins with the tilled row and ends in the sea. The Sabbath of the land, which was an inviolable command to the Israelites, is being restored in systems of rotation and in farm practices that stop drains on soil fertility. For 6 years the soil-saving theme has run through our farm operations. Its results cannot be accurately measured. Nor is the full benefit of land-resting yet evident. Farmers well know that the full results of farming are never evident the following year. Only now are we beginning to realize the heavy losses in soil that resulted from soil-mining methods of farming that were practiced decades ago.

The A. A. A. program is helping farmers make a shift from exploitative to soil-conserving farming. It is assisting them to rely less on soil-depleting crops and more on grasses and legumes. This

means a shift to less intensive farming. In 1938 the soil-depleting acreage was about 12 million acres below the average for the previous 10 years, but supplies were ample, and in some cases there was surplus production. It is plain that farmers have shifted to a type of farming that is easier on the soil and still maintains supplies at an adequate level.

GIVING PERMANENCE TO INCOME YIELD OF FARMS

While year-to-year assistance can be given to farm income, the job of converting farming into a source of adequate long-time income is largely the job of the farmer working on his individual farm. Government help is a supplement to and not a substitute for individual management by competent farmers. A permanent increase in farm income is the ultimate end of the agricultural adjustment. Its income objective lies in the future as well as the present.

Farm income has suffered because too many farms were dumping surpluses onto the market. It has suffered because too many farmers were dipping deep into their capital assets in the soil to produce low-priced products. The A. A. A. farm program has sought to change direction and effects of that type of farming, and to increase the number of farms which are operated in such a way as to prevent surplus production and soil waste. Soil conservation is essential to a long-time farm income.

SOIL CONSERVATION AND PROFITABLE FARMING

There are more than a billion acres of land in farms of this country. More than half of it is pasture land. About 365 million acres have been used for harvested crops. All of the pasture land and about 70 percent of the cropland are used to feed livestock. We could use to advantage a larger proportion of pasture and hay for feeding livestock. In many cases milk and meat can be produced more cheaply by feeding a larger proportion of pasture and hay. Hay and grass are also easier on the land.

A shift away from surplus harvested crops to use of land for the production of pasture and hay is encouraged by the Agricultural Adjustment Administration program. Such a shift lessens the heavy toll that farmers pay annually in the form of soil fertility lost by erosion. Some of the cropland shifted was seeded to pasture, some was fallowed to conserve moisture, and some was planted to legumes and other crops in rotation. None of this land was retired from production. None of it was idle. It produced and improved while shifted from intensive cultivation.

In the past our farming systems had tended to concentrate labor and expenditures upon land devoted to harvested crops. There was a tendency to neglect pasture. During 1938 farmers cooperating in A. A. A. programs applied 5½ million tons of lime and fertilizer to their land, with a view to making grassland more productive of feed for livestock.

THE CONTRIBUTION OF GRASS

At last we have realized the important contribution that grass has made to our meat supply on the range. We have realized, too,

that because of neglect of our grass resources, range feed is no longer as bountiful as it once was. Better range means more efficient livestock production year after year. This country has definitely embarked upon a program to improve the range. Ranchers can select from the range program those improvement practices which are best adapted to their ranches. This program lessens the burden upon the range so that the best native grasses may have an opportunity to reseed naturally. It removes the handicap which exploitation imposed upon the self-perpetuation of natural forage.

Another feature of the program conserves water, so that stock may be better distributed. Still another feature strikes at the forces of erosion, and helps cattle in their competition for forage on the range. Grass restoration occurs on a large scale on the range, and it is needed on millions of farms throughout the United States.

RESTORATION OF SOIL RESOURCES

For several generations, soil exploitation has put farming out of tune with nature's restoratives. Grass, brooks and rivers, the birds of the air, trees—all these have their place in making and keeping soil resources available to farmers for conversion into food and fiber. The period of so-called profitable soil exploitation has come to an end. It is time now to restock the soil and to give nature's restoratives a chance to function.

Good farming keeps up its inventory of soil fertility; exploitative farming does not. Farm returns often have not been adequate to enable farmers to rest their land and restore the supply of plant nutrients that were taken out during long periods of exploitation. Soil conservation payments help farmers do this; to receive them farmers must carry out practices beneficial to their land.

Almost three-fourths of the cropland in the United States was included in the 1938 A. A. A. program. That means that a system of farming which is easier on the land, and which makes for more permanent profit, is operating on the great majority of crop acres which provide farm supplies to our cities and a livelihood to our farm population. It means that soil exploitation is lessened on the bulk of our cropland; that price-ruining surplus production is being cut down; that this kind of production is being diverted to the increasing of soil fertility; and that the handicap is being removed on nature's way of keeping land productive.

IV. THE FARMER'S INCOME

Gross farm income in 1938 was about $9,300,000,000. This is less than the level of farm income attained in 1937, which well exceeded $10,000,000,000. However, it is considerably above the level to which farm income fell in 1932, prior to the application of the farm-recovery measures which included the Agricultural Adjustment Act. Gross farm income in 1932 was about $5,600,000,000. Since 1932 there has also been an improvement in the farm share of the total national income. In 1932 agriculture's share was about 6 percent of the total. In 1938 it was over 9 percent, and in 1937 almost 10 percent.

Farm income figures themselves do not tell a complete story of the economic welfare on the farm. Several other factors must be taken

into consideration. Did this increase in total income mean that farmers could buy more with it, or did the prices that farmers have to pay for products they bought increase as much as their income? After paying their production costs, did increased income leave more money available for living, or did higher farm expenses eat up all the income gains?

FARMER'S PURCHASING POWER ADVANCES

In 1938 the exchange value of farm products was about 78 percent of pre-war. It was over a fourth larger than the 1932 exchange value. Prices farmers received for their products increased more rapidly than the prices at which they bought nonfarm products.

Taking into account the decline in prices that farmers paid, their 1938 income was able to buy over 90 percent as much as the 1929 income.

This restoration of purchasing power was quite generally shared except in regions that were affected by drought. Farm buying power in the North Atlantic States, in the East-North Central States, and in the South Atlantic States was from 5 to 9 percent higher in 1938 than in 1929; in the South Central States and the Western States it was more than 90 percent of the 1929 buying power. In the West-North Central States, where abnormally poor crop conditions affected farm income, buying power was about 79 percent of the 1929 level.

MORE INCOME AVAILABLE FOR LIVING

What concerns farmers is how much money they have left for living at the close of a year after paying such costs involved in farming as seed, fertilizer, taxes, and interest. This is the measure of how well farm families live. This is their living residue.

The income available for living has increased more rapidly than gross income. While gross farm income in 1938 was slightly less than double the income of 1932, the farm income available for living was well over twice as great. After paying the most important production expenses, farmers in 1932 had less than $2,000,000,000 left for living. In 1938 farmers had for living about $4,400,000,000 above production expenses.

It is obvious that agriculture has made a vigorous recovery since the low point of the depression, and although farm income receded from the high point of 1937, the year 1938 found agriculture as a whole maintaining most of the gains that had been made in buying power.

COUNTRY SHARES BENEFITS FROM LARGER FARM BUYING POWER

Improved farm buying power also has made its contribution to the restoration of commerce. Rural retail trade is the point at which the products of industry meet the farm dollar. This is the outpost for industry's products destined for the farm.

The increase in farm buying power has been accompanied by an increase in rural retail sales. As compared with 1932, rural retail sales in 1938 were 80 percent higher, farm machinery sales 439 percent higher, and automobile sales in farm States more than 100 percent higher.

With the increase in farm income, the distressing effect of heavy farm indebtedness which was felt throughout the country has been somewhat alleviated. Farm indebtedness has declined by about $2,000,000,000 since 1932.

Prior to that time most of the decreases in farm indebtedness resulted from foreclosures, but since then increased farm income has made possible an orderly retirement of the burden of debt on the farm.

HOW FARM PROGRAMS HELPED INCREASE INCOME FOR FARMERS

Direct additions to farm income were made through the A. A. A. payments to farmers. Payments during the 1939 fiscal year totaled $640,000,000, which added 8½ percent to the income from sales during this period. This direct contribution to farm income can be accurately measured. There are other effects on farm income exerted by the farm program which are more difficult to determine with accuracy.

Acreage allotments, designed to adjust production to requirements, are fundamental to a healthy price and income situation. Farm income is also affected by operation of marketing quotas which are provided under the Agricultural Adjustment Act for use by farmers when supplies exceed certain levels. Voting in favor of these quotas, cotton and tobacco farmers in 1938 protected their income by holding down the acreage planted to these crops and avoiding the piling up of additional surpluses.

The commodity loans have also exerted an influence on farm income. The loans authorized under the Agricultural Adjustment Act are not intended as price-pegging devices. There is a recognition, however, that farmers cannot operate profitably when prices fall below certain levels. In these situations loans definitely support prices. However, the marketing quota provisions of the act make it possible for such loans to be made with the assurance that supplies going on the market will be regulated. This is a protection to the loan program. Under the corn loan plan, farmers put aside a part of their surplus for feeding when livestock prices are better. They are assured of immediate cash on their stored corn equal to the loan value and they are able to wait for any advance in price that may occur. The loan is a part of the Ever-Normal Granary plan.

Under a similar plan, surplus corn was thus stored in 1933, and increased in marketable value in the drought of 1934, when supplies were badly needed. Under the 1938 loan program 257,000,000 bushels of corn were stored on farms where produced. In 1938 loans on stored wheat retained in possession of the grower were made available to wheat growers. Of their surplus, wheat growers set aside 85,700,000 bushels of wheat under this loan plan, which also included price-supporting provisions.

Cotton producers were likewise offered a loan and about 4½ million bales of the 1938 crop were placed under the loan, bringing the total amount under loan to approximately 11,250,000 bales.

RELIEF FROM PRESSURE OF LOWER WORLD PRICES

When the depression came, producers of export products, such as wheat, cotton, and pork, suffered heavy losses of income. That part

of their production which was exported tended to set the price for their entire production. Thus, when wheat was exported the price at home tended to be set around the world market level, even though purchasing power in this country was above that abroad.

For both wheat and cotton, however, the returns from that portion of the crop used for home consumption were maintained above the world market level during 1938 with the aid of the farm programs.

IMPROVING THE MARKET FOR FARM PRODUCTS

While more than 90 percent of our farm production is consumed at home, the world market is still an important source of income for producers of some products. Wheat, cotton, and tobacco are examples. We have natural advantages and farming methods that enable us to put some products on the world market as cheap as or cheaper than can competing countries. These advantages have been offset by import barriers and export subsidies which competing countries give their farmers. Efforts are now being made to remove some of these handicaps through trade agreements to permit a freer movement of trade. But until this is done, this country is helping the American farmer keep his share of the world market by means of export subsidies and other aids. Approximately 107,000,000 bushels of wheat were moved into export during 1938–39 and more than four-fifths of this amount was exported with the help of Government subsidy.

This country has consistently cooperated in attempts to regulate world trade in wheat by international agreement and has taken the initiative toward an international cotton agreement. Until such agreements can become effective, however, the United States is forced to take necessary steps to protect its producers in the markets of the world.

Relief distribution of farm products is helping to supply a part of the home market that lacks adequate purchasing power to pay farmers fair prices. Fitting production to the market is one part of the farm program, but an expanding market is also a part of that program. In the reorganization of the Department of Agriculture in October 1938, the market-expansion functions were transferred from the Agricultural Adjustment Administration to another agency, but these functions still bear a close relationship to the operation of the A. A. A. farm plan.

V. THE DEMOCRACY OF THE FARM PROGRAM

No report of the activities of the Agricultural Adjustment Administration can be complete without an appraisal of the economic democracy which is expressed in part by the A. A. A. farm committees. During the more than 6 years of existence of the Agricultural Adjustment Administration, farmers have gained, through democratic processes, the administrative experience and developed the leadership to enable them to conduct any farm program that may be adopted. In every farm county in the United States—more than 3,000 of them—farmers themselves have elected certain of their neighbors to serve as county and community committeemen for the local administration of the program.

Today these committees are more important than ever before. This is a time when agriculture must be prepared to move rapidly. Now is a time when experienced leadership is essential. Today there are more than 100,000 of these committeemen. These men who have an intimate knowledge of the local operation and administration of the program represent real agricultural leadership.

The placing of responsibility for the local administration of this program upon farmers themselves has been a cardinal principle of the Agricultural Adjustment Administration since its beginning. This adherence to the democratic ideal in economic affairs gives added significance to the A. A. A. program.

PROGRAM DEPENDS ON INDIVIDUAL FARMER

A farm program remains a lifeless thing until farmers apply the program to their own farms. Most of the soil-conserving methods, as well as methods for improving prices and methods for stabilizing supplies, have long been known to farmers. Individual farmers have long been familiar with the potential results that can be expected from the application of these methods. However, certain economic conditions stood in the way of their more extensive use. The chief job of the A. A. A. program is to remove the obstacles in the path of these farming methods, and to provide an incentive to their more extensive use. The Agricultural Adjustment Administration does not put soil conservation practices in effect on an individual farm; it helps farmers meet the temporary cash outlay entailed in practicing soil-conserving farming. It does not stabilize supplies of farm products; it makes it possible for farmers to keep their production in line with market demands, and furnishes a surplus storage plan. It does not fix prices for farm products; it encourages farmers to keep production at a point that will bring them better prices, and it provides price-supporting loans on important commodities. In short, it forces nobody to do anything, but does make it possible for farmers to help themselves.

The Agricultural Adjustment Act offers farmers a program. It presents methods of farming that can be applied to farms to produce better income and more assurance of profitable farming over a long time. If farmers did not apply it to their farms, the Agricultural Adjustment Act would be merely a scrap of paper.

One important test of the Agricultural Adjustment Act is the the question: How many farmers are applying it? In 1938 the number of farmers who complied with provisions of the program increased to a total of 5,248,796—over 40 percent more than the number for the previous year. The fact that all these farmers are cooperating indicates that the program can be fitted advantageously to widely varying farming conditions; it is a tribute to the program, and to the effectiveness of the farm committees who administer the program in their localities.

CHAPTER 2

THE 1938 A. A. A. PROGRAM

The 1938 program of the Agricultural Adjustment Administration was designed to carry out legislation assigned to this agency for administration. This legislation, which is intended to promote soil conservation on farms, improve farm income, and provide a more even and adequate flow of supplies of farm products, is included under provisions of the Soil Conservation and Domestic Allotment Act, the Agricultural Adjustment Act of 1938, and related legislation. The various activities coordinated in the 1938 program of the Agricultural Adjustment Administration are:

Keeping soil-depleting crops within acreage goals, and distributing the goals among farmers by means of acreage allotments;

Carrying out farm practices beneficial to the soil and encouraging production of soil-conserving crops;

Making payments to producers for participation in program;

Stabilizing supplies of key crops by means of loans and marketing quotas;

Administering or assisting in the administration of special programs such as those for range, naval stores, and crop insurance;

Maintaining facilities for farmer participation in administration and formulation of programs;

Formulating and initiating program for 1939.

These activities are given varying emphasis—to meet the individual problems of the producers of various crops and to adjust farming in various regions. Although administration of the commodity programs is on a regional basis, a large part of the foundation work for the programs dealing with each of the basic crops is undertaken by the division for the region where the crop is predominant. On such a basis, the Southern Division is assigned cotton; the North Central, corn; and the Western Division, wheat.

I. ACREAGE GOALS FOR SOIL-DEPLETING CROPS

National goals for soil-depleting crops were established with a view to the acreage of soil-depleting crops that can safely be grown from the standpoint of soil conservation and to the acreage of each particular crop needed for current domestic and export demands and adequate reserves. These considerations are in line with the objectives of the Soil Conservation and Domestic Allotment Act. The objectives include preservation and improvement of soil fertility, promotion of economic land-use, diminution of exploitation and wasteful use of soil resources, and the protection of rivers and harbors against the results of soil erosion; maintenance of a stable

and adequate supply of farm products to meet consumer demand at prices that are fair to both producer and consumer; and the operation of the program in such a way that the production of supplies sufficient to maintain normal domestic consumption will not be discouraged. For five products—cotton, wheat, rice, tobacco, and corn—supply levels sufficient to allow for protective reserves were specified in the Agricultural Adjustment Act of 1938, and these specified levels determined largely the goals established for these crops.

The national soil-depleting goal was the total of special national goals. These special goals were: General soil-depleting (which included wheat and other small grains), cotton, tobacco, corn, potatoes, peanuts, and rice. For cotton, tobacco, and rice, acreage allotments applied to counties in which such crops were grown. For corn, peanuts, and potatoes, allotments applied only to those counties which were in the principal commercial-producing areas, as designated by the Agricultural Adjustment Administration. The acreage adjustment affected directly by the program occurred only in these areas. With the exception of corn, wheat, and potatoes, national individual crop goals were set in 1938 only for crops for which there were special soil-depleting bases under the 1936 and 1937 programs. A special goal was included for potatoes, in line with the results of a referendum held among potato growers.

SOIL-DEPLETING CROPS DECLINE 12 MILLION ACRES

In 1938, farmers harvested an acreage of soil-depleting crops substantially smaller than the average for the preceding 10 years, but somewhat larger than the national goal sought. The 1938 goal for all soil-depleting crops was between 275,000,000 and 290,000,000 acres. The acreage of these crops actually grown in 1938 totaled 293,000,000 acres, about 3,000,000 acres more than the maximum goal but about 12,000,000 acres less than the average harvested during the previous 10 years. The cotton acreage grown was nearly 12,000,000 acres less than the average for the previous 10 years and nearly 2,000,000 acres below the minimum goal. The corn acreage grown was nearly 9,000,000 acres below the average for the previous 10 years, and about 1,000,000 acres less than the minimum goal. There was thus substantial achievement of goals for the major crops except wheat. Winter wheat harvested in 1938 had already been planted when the 1938 program got under way and compliance with total soil-depleting acreage allotments rather than with wheat acreage allotments was a condition for payment. Under these circumstances, although the Agricultural Adjustment Act of 1938 fixed a wheat acreage allotment at 62,500,000 acres for the purpose of computing payments, the acreage planted was about 17,000,000 acres above the allotment.

The average acreage harvested during the 10 years prior to 1938, the goals established under the 1938 program, and the acreage grown in 1938 for each of the crops or groups of crops for which goals were established are as follows:

Crop	Acreages (thousands of acres; i. e., 000 omitted)		
	1928-37	1938 goal	Grown in 1938
Corn	102, 429	94,000 to 97,000	93, 689
Cotton	36, 801	27,000 to 29,000	25, 018
Rice	913	825 to 875	1, 076
Tobacco:			
Flue-cured	928	850 to 875	912
Burley	396	440 to 460	407
Dark tobacco	232	170 to 180	152
Filler, binder	98	85 to 90	80
Peanuts	1, 377	1,500 to 1,600	1, 708
Potatoes	3, 411	3,100 to 3,300	3, 082
All soil-depleting	305, 000	275,000 to 290,000	293, 000

ACREAGE ALLOTMENT FOR SOIL-DEPLETING CROPS

Two considerations were involved in distributing the acreage allotments of soil-depleting crops: Soil-conservation needs of the individual farm; and an equitable share of the market for the farmers. County committees, with the aid of local committees in the county and in accordance with procedure established by the Agricultural Adjustment Administration, established total soil-depleting acreage allotments for each farm on the basis of several considerations. These included good soil-management requirements for the farm, the total tillable acreage on the farm, type of soil, topography, degree of erosion, acreage of soil-depleting crops customarily grown on the farm, and the acreage allotments for individual soil-depleting crops. The 1938 program also gave more consideration to the needs of areas in which the production of food and feed for home use is deficient, and this, too, was considered in apportioning the soil-depleting acreage allotment.

The provisions made for equitable distribution to small producers and to new producers and the allowances for the development of trends in production under the program are set forth in detail in the bulletin for the 1938 program, which is published as an appendix to this report. (P. 93.)

II. SOIL-BUILDING PRACTICES UNDER THE 1938 A. A. A. PROGRAM

In addition to keeping soil-depleting crops adjusted to market requirements and thus lessening exploitative use of land, the program also encouraged the expansion of acreages of soil-conserving crops, such as grasses and legumes, and the building-up of land devoted to these crops by the use of lime and fertilizer. Soil-building practices also included such methods of controlling erosion as contour cultivation and furrowing, terracing, water spreading, basin listing, and strip cropping.

New seedings of legumes and grasses for which farmers earned payments under the program totalled 30,074,685 acres, as compared with 29,071,870 acres under the program of the previous year.

More than half of this acreage was seeded to biennial and perennial legumes and perennial grasses, a total of about 17,500,000 acres. About 9,600,000 acres were seeded to annual legumes and grasses.

Farmers, in complying with the program, planted a total of 25,243,669 acres of green-manure and cover crops, which was more than double the acreage planted to these crops in complying with the 1937 program. Of this acreage, 17,457,685 acres were planted in States of the South.

Forest tree practices, which include planting trees in woodlots and for windbreaks, maintaining stands of trees, improving stands, and fencing off woodlots to prevent grazing, were carried out on 196,785 acres. Of this total, 55,445 acres were planted to trees, and stands were maintained and improved on 141,340 acres.

The program's pasture practices included reseeding and contour ridging. Natural reseeding by deferring grazing was carried out on 2,012,750 acres in addition to more than 28,000,000 acres reseeded under the range program.

LIME AND FERTILIZER APPLICATIONS

A total of 5,546,994 tons of limestone and fertilizer was applied in complying with the program. Limestone applications totalled 5,019,292 tons; applications of 16 percent superphosphate or its equivalent totalled 496,638 tons; and applications of muriate of potash totalled 12,035 tons.

Provision was made under the 1938 program for furnishing superphosphate, limestone, seeds, trees, and other materials as grants-of-aid in lieu of cash payments for compliance when producers filed request for these materials. Under the 1937 program superphosphate was thus supplied to farmers in a number of States in the East Central and Southern Regions within economical shipping distance of the Tennessee Valley Authority plant in Sheffield, Ala. Arrangements were again made with the Tennessee Valley Authority to continue this phase of the program in 1938. Limestone also was made available to farmers in a number of areas where it had been difficult to secure adequate supplies at a reasonable price.

Under the 1938 program distribution of materials as grants-of-aid totalled $2,384,502. For this distribution, 66,851 tons of triple superphosphate were purchased at a cost of $2,218,603; 33,751 tons of liming materials at a cost of $104,187; and 1,281,000 pounds of seeds at a cost of $61,711.

An arrangement also was made with the Forest Service to furnish and plant trees for farmers in certain parts of the Great Plains area, and where this was done a deduction of $10 per acre of trees planted was made from the farm payment and transferred to the Forest Service.

EROSION-CONTROL PRACTICES

Erosion-control practices, exclusive of terracing and construction of dams and reservoirs, were applied to 15,990,306 acres under the program. Protected summer fallowing, a practice readily adaptable to dry-land farming improvement, was applied to 7,471,210 acres—nearly half of the total to which erosion-control practices were applied. Contour farming of intertilled crops was applied to 4,510,508

acres. Other erosion-control practices were carried out as follows: Strip cropping, 713,207 acres; contour seeding of small grain crops, 982,430 acres; contour listing and basin listing on the contour, 1,945,772 acres; other basin listing, 268,875 acres; contour listing or furrowing noncrop land, 96,467 acres; protecting muck land by windbreaks, 1,837 acres. In complying with provisions of the program, 392,036,000 linear feet of terracing were constructed and 5,638,125 cubic yards of earth were used in the construction of dams and reservoirs.

The total earned by farmers for carrying out these soil-building practices under the 1938 program is estimated at $77,725,000, which does not include payments made under the restoration land, range, and naval stores programs.

RESTORING LAND TO NATIVE COVER

A program was instituted in 1938 for restoring, insofar as practicable, a permanent vegetative cover on land in the Great Plains area unsuited to the continued production of cultivated crops. Some of the land on which cultivation is most hazardous has been purchased by the Federal Government, permanently retired from cultivation, and put to other economic uses. In its restoration land program the Agricultural Adjustment Administration made it possible for individual farmers to cooperate by retiring land unsuited to cultivation and restoring it to native cover. Under this program about 3,500,000 acres were designated as restoration land.

Payments under the 1938 program totalled $1,524,000, earned by producers of 10 States: Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming. Payment for retiring land and restoring it to vegetative cover was at the rate of 50 cents per acre.

III. PARTICIPATION AND DISTRIBUTION OF PAYMENTS

Under the 1938 program, 5,248,796 farmers earned conservation payments, as compared with 3,657,496 under the 1937 program—an increase of 1,591,300, or more than 40 percent. This increase occurred in all regions, although it was particularly marked in the Southern and East Central States. Increases in the South alone accounted for nearly a million of the additional participants.

The acreage of cropland in farms participating in the program totalled 320,693,478 acres, or more than 72 percent of the cropland in all this country's farms. This is an increase of 38,000,000 acres in participating cropland over that of the previous year. More than three-fourths of this increase occurred in States of the South. The increase in the number of farmers participating was relatively larger than the increase in the participating crop acreage, indicating increased participation of small farms and farms with a relatively small proportion of cropland.

DISTRIBUTION OF PAYMENTS

Of the total payments of $443,691,000 earned by producers under the 1938 conservation program, approximately 75 percent was earned

for complying with the acreage allotments established under the program. The total for compliance with cotton allotments is estimated at $141,689,000; for compliance with the allotments for general soil-depleting crops, $127,642,000, of which $50,458,000 was earned by wheat producers in connection with the allotments for wheat; for compliance with the allotments for corn, producers in the commercial corn area earned $61,044,000. The amount for compliance with allotments for tobacco is estimated at $10,133,000; for potatoes in the commercial area, $6,115,000; for peanuts for nuts, $1,217,000; and for rice, $1,909,000.

Payments to farmers for remaining within their acreage allotments for general soil-depleting crops were made at the rate of $1.25 per acre, adjusted for productivity, for each acre in the allotment. The payments for individual crop allotments were made on the normal yield of the allotted acreage at the following rates: Cotton, 2.4 cents per pound; corn, 10 cents per bushel; wheat, 12 cents per bushel; tobacco, 0.5 cent to 1.8 cents per pound, depending upon the type of tobacco; potatoes, 5.4 cents per bushel for early potato-producing areas, and 3.6 cents per bushel for late producing areas; peanuts, 0.2 cent per pound; and rice, 0.125 cent per pound.

MORE SMALL PRODUCERS IN PROGRAM

More participation by small producers, which was one of the objectives of the program, is also indicated by the increase in the number of small payments made. This was equal to nearly two-thirds of the total increase in farmers participating. There was an increase of over 916,000 producers who received payments totalling less than $60. The number of producers who received payments of less than $40 increased by more than 412,000, and there was an increase of 160,000 in the number of producers who received payments of less than $20.

Over 93 percent of the participating farmers earned payments of less than $200, and these payments were increased under the provision of the Soil Conservation and Domestic Allotment Act, as amended, which established a formula for scaling small payments upward.

The formula for scaling small payments upward, which was effective for the first time in the 1938 payments, provides for increases for all payments of less than $200, though the rate of increase lessens as the payments increase in size. Payments totaling $20 or less are increased 40 percent; payments of $21 to $40 are increased by $8 plus 20 percent of the excess over $20; payments of $41 to $60 are increased by $12 plus 10 percent of the excess over $40; payments of $61 to $186 are increased by $14; and payments of $186 to $200 are increased to $200.

IV. STABILIZING SUPPLIES OF MAJOR CROPS

The Agricultural Adjustment Act of 1938 provided for stabilizing the supplies of five major crops at adequate levels. The crops are cotton, corn, wheat, tobacco, and rice. The stabilizing provisions include acreage adjustment, storage of surpluses under loans, and marketing quotas to regulate marketing when supplies are excessive. Loans are directed, at specified rates, when certain conditions of

supply or price prevail for wheat, cotton, and corn. Marketing quotas, applying a penalty for marketing in excess of the quota, are also proclaimed under specified conditions, although a quota becomes effective only when it receives the approval of at least two-thirds of the farmers voting in a referendum.

1938 CROP LOANS DIRECTED FOR COTTON, CORN, WHEAT

In 1938 commodity loans were offered on cotton, corn, and wheat. These loans are made by the Commodity Credit Corporation, and certain of the terms and conditions are fixed upon recommendation of the Secretary of Agriculture and with the approval of the President.

Loans on corn become mandatory when the November crop estimate for corn is in excess of a normal year's domestic consumption and exports or when the farm price of corn on November 15 or at any time thereafter during the marketing year is below 75 percent of the parity price. The 1938 November estimate of the corn crop was 2,480,985,000 bushels, which was in excess of the normal year's domestic consumption and exports. In accordance with a loan rate schedule in the act, the rate was set at 57 cents per bushel, or 70 percent of the parity price, which at that time was estimated at 81 cents per bushel. This rate was available to farmers in the commercial corn area who had planted within their acreage allotments. Loans were made available to cooperating farmers outside of the commercial corn area at 43 cents per bushel.

A total of 227,000,000 bushels was put under loan in 1938, and in addition a total of 30,000,000 bushels of corn under the 1937 loan was resealed. Corn under loan is stored on the farm where produced.

The 1938 wheat loan was offered to producers at rates averaging between 59 and 60 cents a bushel at the farm. This rate was approximately 52 percent of the parity price of wheat, which was $1.14 at the time. The Agricultural Adjustment Act of 1938 directs a wheat loan when the farm price on June 15, or at any time thereafter during the marketing year, is less than 52 percent of parity, or if the July crop estimate exceeds a normal year's domestic consumption and export. While the June 15 farm price was above 52 percent of parity, the July crop estimate of 967,000,000 bushels was substantially above a normal year's domestic consumption and exports.

Wheat put under loan totaled about 85,700,000 bushels, which was stored in warehouses and on the farm.

Cotton loans in 1938 were required when cotton prices fell below 52 percent of parity. The rate was established at 8.3 cents per pound for seven-eighths-inch middling cotton, which was about 52 percent of parity. About 4,480,000 bales from the 1938 crop, more than one-third of the year's production, were put under loan. This, added to loan cotton from previous crops, brought the total under loan to about 11,000,000 bales.

MARKETING QUOTAS APPLIED TO FOUR COMMODITIES

Marketing quotas were in effect under the 1938 program for cotton, flue-cured, Burley, and dark tobaccos. The supplies of these commodities exceeded levels at which the Secretary of Agriculture was

directed to proclaim a quota, and the quotas were approved by more than two-thirds of the producers voting in referendums. A total of more than 2,000,000 farmers voted in the referendums which approved the quotas. In each case the approving vote was well above the required two-thirds majority of the voting producers. Penalties for excess marketings, as stipulated in the 1938 Act, were as follows: Cotton, 2 cents per pound; flue-cured and Burley tobaccos, 3 cents per pound, or 50 percent of the sales price if that is higher; and dark tobaccos, 2 cents per pound, or 50 percent of the sales price if that is higher.

V. ADMINISTRATION OF SPECIAL PROGRAMS

The Agricultural Adjustment Administration either carries out or participates in the administration of a number of special programs such as the range program, the Federal crop insurance program, and the naval stores program.

THE 1938 RANGE CONSERVATION PROGRAM

The range conservation program adapts the agricultural conservation program to the specific needs of the range as a means of obtaining conservation of range land and a more efficient and stable livestock production year after year. Essentially the range program encourages and assists the individual rancher in protecting the western grasslands. Under the program, operators, county committees, and qualified range technicians pool their knowledge and experience to work out sound improvements for each individual ranch.

The range program operates in the 17 Western States including all or a part of Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. In this range area there are 728,000,000 acres of range land. About one-half of this range is under Federal, State, and county ownership.

In 1938 there were 189,851,257 acres of range land included in the 45,168 ranches which participated in the program. The total grazing capacity for this area was 8,483,640 animal units, or 22.4 acres per animal unit.

Under the range program, an allowance is established for each participating ranch. The allowance is determined on the basis of the number of animal units which the ranch is capable of carrying and the number of acres in the ranch. The rancher may earn this allowance by carrying out practices at rates of payment established for various range-improving practices included in the range conservation program. Payments represent only part of the cost of the conservation work. The remainder of the expense is borne by the stockman.

Range-building practices under the 1938 program were designed to accomplish the conservation of range land by two methods: First, by restoring grass; and second, by protecting grass.

The practices offered under the 1938 program followed the general outline of previous years, but placed more emphasis on the reseeding of range land by deferred grazing. Fencing and rodent control were dropped from the list of practices directly qualifying for payment.

The method of determining the range-building allowance was also slightly changed from the previous year, giving less weight to the grazing capacity of the unit than formerly. This gave to the more depleted units a somewhat higher allowance than the old method, and made range appraisals more of a management-guide figure. In order to induce a greater number of operators to initiate deferred grazing, the payment was materially increased with the requirement that certain range-building practices of local importance should be performed in addition to deferred grazing in order to qualify for the larger payment.

Under the 1938 program, ranchers restored grass by permitting the grass to reseed naturally through deferred grazing. Range was also reseeded artificially. During the program year, 28,077,000 acres of range land were reseeded naturally by deferred grazing. Ranchers who reseeded their range artificially used 1,373,000 pounds of approved seed.

Forage growth was increased by a series of practices which included control of water run off and development of watering places. By the construction of spreader dams and terraces, snow and rain water, which otherwise would run off, are held on the range land and the moisture permitted to soak in. Under the 1938 program, 2,256,000 cubic yards of earth were removed in the construction of spreader dams, and 7,713,000 linear feet of spreader terraces were constructed.

The principal water-development practice designed to improve distribution of stock on the range was construction of earthen tanks or reservoirs. Ranchers earned payment for moving 35,416,924 cubic yards of earth in their construction. Rubble masonry dams involving 73,195 cubic yards were constructed. Development of water supplies also was furthered by drilling wells and by developing springs or seeps. The wells involved 871,946 linear feet of digging, and the springs and seeps 652,456 cubic feet.

In addition to the construction of spreader dams and terraces, erosion on the range was retarded by contour listing, furrowing, and subsoiling on 158,032 acres, and contour ridging 58,687,000 feet in length. The latter practice was carried out only in Oklahoma and Texas.

In Oklahoma and Texas, the elimination of destructive plants was a practice included in the program to protect range grass from competition. In these two States, pricklypear and cactus were eliminated from 1,572,400 acres, mesquite from 155,000 acres, cedar from 630,950 acres, and lechuguilla from 74,500 acres.

As a means of improving fire protection on the range, 19,039,086 linear feet of fireguards were constructed.

In Nebraska, South Dakota, Oklahoma, and Texas, the planting of forest trees was included as a practice. A total of 4,805 acres was planted to trees and existing trees were maintained on 717 acres.

In 1939 no material change was made from the 1938 program. Some of the implied provisions of the 1938 program were made more specific. It was provided that no range-building payment was to be made to operators who failed to adopt or maintain a sound range-management program of a conservation nature. The policy of appraising individual grazing-capacities at a level that would maintain a sustained yield of forage was continued.

An important byproduct of the range conservation program is the opportunity it gives range operators to learn the value of practices which they otherwise would have to postpone or not do at all. In addition to this, the grazing-capacity appraisals made under the program for each participating unit furnish the ranchers with definite and scientifically gathered information concerning the forage on their ranches. On the basis of such information they are better able to determine what the stocking rate on their ranches should be to permit a sustained yield of forage and a gradual restoration of the more desirable range forage plants.

NAVAL STORES CONSERVATION PROGRAM

Conservation of timber resources, prevention of their uneconomic use and wasteful exploitation, and the improvement of fire protection in the naval stores region, were objectives of the 1938 conservation program for gum naval stores producers. The program was administered by the Forest Service and financed by funds made available to the Agricultural Adjustment Administration for conservation purposes.

Naval stores farmers were paid at the rate of 1 cent per "face" (chipped area of the tree from which the gum flows) for all faces worked under approved practices, and 5 cents per face for faces taken out of operation on small trees as required by provisions of the program. Damage to future usefulness for merchantable timber is not as serious in the case of large trees as it is in the case of small trees.

Payments earned under this program approximated $997,000. Farmers participated in the States of Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina, and Texas.

CROP INSURANCE LINKED WITH AGRICULTURAL CONSERVATION

While wheat harvested in 1939 was the first crop to which the Federal crop insurance applied, much of the work of initiating the program was done during the time that the 1938 A. A. A. program was in effect.

The administration of the crop insurance program was closely integrated with that of the agricultural conservation program. The Federal Crop Insurance Corporation conducted policy-making, overhead administration, handling of the grain reserve, acceptance of insurance policies, and disbursement of indemnities. Field operations were conducted through the State and county farmer-committees of the A. A. A., which provided a ready-made, trained administrative force on a Nation-wide basis. These committees are in direct contact with all wheat producers and are intimately acquainted with local farming conditions and farm records, which are so important to the insurance program.

The principal aims in the first year of the crop insurance program were: (1) To obtain a sufficiently wide and representative participation to provide a thorough field-test of the plan, (2) to reveal any needs for improvement, and (3) to accumulate basic data on which future yield and rate structures might be built.

The first phase of the program consisted of taking applications from growers, from which insurable yields and premium rates could be calculated. More than 305,000 growers in 1,300 counties filed applications.

After receipt of applications, growers were notified of the amount of premium due, payment of which was required before certain deadlines in each area in order to make the insurance effective on the 1939 crop. Many growers were unable to meet their premium payments because previous years of crop losses had left them with little wheat, cash, or credit. However, an amendment to the Agricultural Adjustment Act, approved March 25, 1939, made it possible for growers to pay premiums with advances against payments to be earned under the agricultural conservation program. This amendment came too late to aid winter wheat growers, for whom deadlines for payment had passed, but helped spring wheat growers materially.

As of June 30, 1939, approximately 165,271 growers had paid premiums to insure wheat planted on 7,536,139 acres. More than 90 percent of the policies were for 75-percent coverage. Growers were insured a production of approximately 63,000,000 bushels by the policies in force. The average State policy ranged from 133 acres and 1,700 bushels per farm in Washington to 8.39 acres and 91 bushels per farm in Wisconsin. The national average was 45.6 acres and 379 bushels. Policies were in force in approximately 1,300 counties of 31 States.

The adjustment of losses sustained by insured wheat growers began in the late winter and early spring for winter wheat, and in the late spring for spring wheat. Adjustments were handled by county A. A. A. committees. Adjustments were made on three types of losses: (1) Total loss, where 100 percent damage had been sustained, could be adjusted and settlement claimed immediately after the loss occurred; (2) "substantially total" loss, where the condition of the crop was such that it would be impracticable for the grower to care for it further (in such cases, the potential yield could be appraised, and settlement requested; in both "total" and "substantially total" losses, the grower could obtain permission to put the land to other use after the loss had been adjusted); and (3) partial loss, where damage occurred but the exact amount could not be determined until the crop was threshed and the yield measured.

As of June 30, 1939, approximately 5,000 loss claims had been approved, representing more than 1,000,000 bushels due farmers in indemnities. The adjustment of losses to the 1939 crop could not be completed until late in the fall, following the threshing of the crop in the latest harvesting areas. It was estimated, however, that about 45,000 loss claims would be paid, representing total indemnities of approximately 7,500,000 bushels.

During its first experimental year, the insurance program was field-tested, and it demonstrated the possibilities of the plan on a Nation-wide basis. Some insurance was in force in practically every community in which wheat is an important crop. Enrollment was fairly representative of the various types of farming in all areas in which wheat is grown.

A longer base, earlier determination of yields and premiums, simplification of operation, and further recognition of the use of

improved farm practices are among the revisions made in the program for application to the 1940 wheat crop. There will be no policies written for 1940 insurance, the application serving as a contract after the premium is paid and the application accepted by the Federal Crop Insurance Corporation. The base period for the farm will be 9 years instead of 6, and a special procedure practice will be used to adjust the base period to allow for recently adopted improved farm practices which increase yields and lower risks.

As authorized by the Federal Crop Insurance Act, research is in progress in the Bureau of Agricultural Economics on insurance for cotton, corn, and citrus fruits, and it is anticipated that the work may be extended to other crops. The research work on cotton is furthest advanced.

FIELD WORK ON SUGAR PROGRAM

The field program with respect to the conditional payments to domestic sugar beet and sugarcane producers, authorized by the Sugar Act of 1937, is administered through the Western, North Central, and Southern Divisions for the sugar beet- or sugarcane-producing States covered by these divisions, and through the Insular Division for Hawaii and Puerto Rico. The work in the States, counties, and communities is done by the agricultural conservation committees. The act authorizes the use of these committees in carrying out the conditional-payment provisions of the legislation and provides for deductions from the payments to growers to cover the expenses of the committees when they are engaged in such work.

The conditions of payment include the nonemployment of child labor, payment of not less than the minimum wages fixed by the Secretary, prevention of soil erosion and improvement of soil fertility, marketing or processing within the farm's proportionate share, and in the case of producers who are also processors, payment for purchased cane or beets at rates not less than those established by the Secretary.

VI. COMMITTEES FACILITATE FARMER PARTICIPATION

As in the original agricultural adjustment and agricultural conservation programs, the local administration of the farm program under the 1938 Act and the general shaping of its provisions are in the hands of the farmers themselves. The acreage allotments and the quotas are made through county committees. Farmers are the administrators of the program in their counties.

The act specifies that farmers in every farming community in the United States hold annual elections of community committeemen and of community delegates to county A. A. A. conventions. These delegates elect officers of the county agricultural conservation associations and county committees.

At these election meetings, all owners and operators of farms in the community and county who are cooperating in any phase of the A. A. A. programs, or who signify their intention to cooperate by signing an application for membership in the County Agricultural Conservation Association, are eligible to vote.

COUNTY AND COMMUNITY COMMITTEES

Community committees are elected annually from membership of the county agricultural conservation associations. Each such committee is limited to three members, whose duties include: Preparing, checking, and approving forms used in connection with the programs; recommending acreage allotments and soil-building goals for farms in the community; assisting in checking performance, as a preliminary step in granting loans and payments; and helping county committees and extension agents in the educational work of the program. In 1938 there were 23,487 community committees, the members of which were paid at a per diem rate for time actually spent in the discharge of their duties.

County committees of three farmers each are elected by county delegates chosen by the community farmers at the same time the community committees are elected. The county committee elects a secretary, who may be the county agent; in case the county agent is not elected, he is nevertheless an ex officio member of the committee without power to vote.

The county committees review forms and other documents filed in the county in connection with the programs; apportion county acreage allotments among individual farmers in accordance with standards fixed by the act; fix soil-building goals; supervise preparation of applications for payments and loans; and perform general county administrative work. In 1938 there were 3,006 county committees in the United States. Members of these committees are paid on a per diem basis.

FUNCTIONS OF STATE COMMITTEES

The State committees are composed of farmers and the State director of the Extension Service, who is always a member. The farmer members, usually four in number, are appointed by the Secretary of Agriculture, upon recommendation of the Administrator, who generally consults with the State Extension director and officials of the principal farm organizations before making his recommendations.

The State committees are in direct contact with the Agricultural Adjustment Administration headquarters in Washington. They are in general administrative charge of the program in the State. Within the framework of law and national A. A. A. policy, and keeping always in close touch with county and community sentiment, they determine State policies and direct the application of the program in the State. Their work, in part, is to review county recommendations for acreage allotments and soil-building goals; hear appeals from decisions of county committees; advise the regional director on general policy within the State; outline soil-building and range-building practices; and recommend changes in the program, as well as assist in the development of new programs.

The community meetings, at which the farmers' attitudes are first recorded, offer farmer-members opportunity to learn what administration of the program is costing them. County administrative costs are paid by the Association members on a pro rata basis.

Throughout the history of the A. A. A., farmers have made recommendations which have helped in the formation of the programs, and many of the practices which have been incorporated in the program have been the result of these farmer-recommendations.

VII. CHANGES IN PROGRAM FOR 1939

During the period covered by this report, the 1939 program was formulated and was put into effect with the plantings for the 1939 crop.

The year 1939 was the first one in which the program made possible under the Agricultural Adjustment Act of 1938 could be fully effective.

While final details are not yet available, the picture for 1939 is sufficiently clear to make a preliminary appraisal in this report. Participation in the 1939 program has been the highest in the history of the A. A. A. farm programs. Preliminary estimates indicate that 82 percent of the cropland of the Nation is included in the farms of those participating which represent 72 percent of the farms of the country.

For cotton and corn there has been a substantial compliance, matching or bettering that of 1938. Wheat farmers, who in 1939 had their first opportunity to use the acreage allotments of the new program, have made the greatest adjustment in acreage in any one year in our history, lowering the wheat acreage by approximately 19 percent. Tobacco farmers, who in December 1938 failed to approve by a sufficient majority a proposal for marketing quotas for 1939, increased their acreage substantially, mainly in the flue-cured areas, with resulting large supplies and lower prices.

On the side of soil-building practices and the wider use of soil-conserving crops, preliminary estimates indicate a substantial increase in this part of the program.

The 1939 program was approved in November of 1938 and is similar in essentials to the program in effect during the previous year. It continues to provide for soil conservation, for a level of agricultural production sufficient to meet the country's requirements and all possible exports, and for adequate reserves—with the individual farmer participating by seeding crops within his acreage allotments and by carrying out soil-building practices.

The 1939 program is different from that of the preceding year chiefly in that it provides larger rates of payment to producers of corn, wheat, and rice; payments are limited to a maximum of $10,000, in accordance with provisions of the Soil Conservation and Domestic Allotment Act, as amended; and the soil-depleting goals are about 5,000,000 acres smaller. The 1939 rates of payment are comprised of the agricultural conservation payments and the price-adjustment payments.

The program provides for the distribution of price-adjustment payments totaling $212,000,000, appropriated by the Price Adjustment Act of 1938, among cotton, wheat, corn, tobacco, and rice producers who remain within their acreage allotments. The payments are based to a large extent on the difference between farm price and parity and cannot exceed the amount by which the average price is

less than 75 percent of parity. Since tobacco prices have been above 75 percent of parity, no price-adjustment payments on this commodity have been made. The price-adjustment payments are made on the normal production of the allotted acreage at the following rates: Cotton, 1.6 cents per pound; corn, 6 cents per bushel; wheat, 11 cents per bushel; and rice, 12 cents per hundredweight.

Price-adjustment payments are in addition to the 1939 soil conservation program payments for which $499,560,000 was appropriated under the Department of Agriculture Appropriation Act for the fiscal year ending June 30, 1940. The rates at which the conservation payments are distributed among producers of various commodities have also been revised. The rate for wheat, which was 12 cents per bushel under the 1938 program, was set at 17 cents per bushel; for cotton, 1.8 cents per pound; for corn, 9 cents per bushel; tobacco, 0.8 to 1.5 cents per pound; potatoes, 3 cents per bushel; peanuts, $3.00 per ton; and rice, 9 cents per hundredweight. These rates are paid on the normal yield per acre of the acreage allotment. The two payments for the four crops make total payments as follows: Wheat, 28 cents a bushel, cotton 3.4 cents a pound, corn 15 cents a bushel, and rice 21 cents a hundredweight.

The goal for total acreage of soil-depleting crops under the 1939 program was established at 270,000,000 to 285,000,000 acres. The goal for the previous year was 275,000,000 to 290,000,000 acres of soil-depleting crops. The lower total goal for 1939 is accounted for chiefly by the smaller acreage goal for wheat.

The maximum limitation on payments, provided under the Agricultural Adjustment Act of 1938 as effective beginning in 1939, restricts to $10,000 the soil-conservation payment that can be made to any individual, partnership, or estate with respect to any farms located within a single State, Territory, or possession. In the case of persons other than an individual partnership, or an estate, the total payment is limited to $10,000.

An effort also has been made under the 1939 program to give increased encouragement to the production of food and feed for home use in areas where there is ordinarily a deficit of such production. To that end the land used for home gardens in these areas could be excluded in calculating the soil-depleting acreage for the farm.

CHAPTER 3

THE PROGRAM IN THE WESTERN REGION

The Western Region has a number of characteristics which distinguish it from the remainder of the country and which at the same time contribute to its farm problem. These characteristics include wide variations in climate, topography, and altitude, and the recent frontier status. Other factors, such as its large amount of irrigation farming and its great variety of crops, have important effects upon the area's farm problem.

The Region includes the following States: Arizona, California, Colorado, Idaho, Kansas, Montana, New Mexico, Nevada, North Dakota, Oregon, Utah, Washington, and Wyoming.

Much of the Region receives less than 20 inches of rainfall a year, a climatic factor which necessitates constant conservation of grass and water if productivity is to be maintained.

The frontier has only recently passed from the Western Region. Here the last of this Nation's free land was available, and here agriculture found its greatest expansion in the boom era that so directly contributed to the development of the farm problem.

Wheat and livestock, the Region's principal agricultural products, reflect two of the major characteristics of the area. Wheat is a crop which can be grown successfully in a comparatively dry climate and to which new land readily can be turned. The western livestock industry is rooted in the Region's extensive range area, where for years it found an ever-extending frontier. The grass on this range, because of the climate and the type of soil, is particularly nutritious.

But while wheat and livestock are foremost, farmers in the Western Region raise about 200 commercial crops, varying from small grains in the dry farming areas to such highly intensified crops as fruits and vegetables in irrigated areas. Production methods vary from planting and harvesting three or four crops in a single year on the same land to cropping every other year.

The national agricultural problems of wasted soil in overproduction and of shrinking farm income have been of as much concern to the Western Region as to the country as a whole. In fact, these problems often have been intensified for the Western Region farmer and rancher and have especially emphasized the need for soil conservation.

In this Region, which is so predominantly agricultural, the problem is one which affects not only the people who make their living directly from the land, but also the thousands who serve the farmer and the rancher in the small towns and cities. But it is a problem which extends farther—to the metropolitan centers whose industries and laborers look to western agriculture for markets, and to consumers

throughout the Nation who at all times need bread, meat, wool, fruit, and countless other products.

To answer the problem, the A. A. A. programs provided the farmers themselves with the machinery for balancing their operations as a step toward soil conservation and a fair income. In the Western Region, the program affected mainly wheat, corn, general soil-depleting crops, potatoes, cotton, and rice, with special provisions covering soil-building and range-building practices.

PARTICIPATION IN 1938

There was a greater degree of participation in the 1938 program than in the 1937 program, as measured by the number of farms, number of payees, acres of farm land, acres of cropland, money paid to farmers, and units of soil-building practices carried out.

Applications for payments were filed in 1938 representing about 600,000 of the 906,000 farms for which detailed information was filed. The participating farms covered an estimated total of 136,522,000 acres of farm land. This is in addition to the approximately 90,000,000 acres of range land on participating ranches in the Western Region and was about 64 percent of the 214,719,000 acres of farm land included in the 906,000 farms for which information was filed. On the basis of cropland, 71 percent, or an estimated total of 72,000,000 acres, was included in application farms.

NET PAYMENT TO PRODUCERS

The total estimate of the net payments to producers in the Western Region under the 1938 program is $67,400,000 and nearly 98 percent of this amount had been certified to the General Accounting Office for payment as of October 20, 1939. Net payments in the Western Region in 1937 were $54,543,000, as compared with $65,398,000 in 1936.

I. THE PROGRAM FOR WHEAT

The early wheat programs in 1933, 1934, and 1935 were primarily programs of adjustment. With the passage of the Soil Conservation and Domestic Allotment Act of 1936 the emphasis was shifted to soil conservation. The adjustment of production was made incidental to conservation. The Agricultural Adjustment Act of 1938 was enacted to broaden and strengthen the program, but the wheat acreage adjustment provisions of the new act were not available in time to be applied to much of the 1938 crop.

THE NATIONAL WHEAT ACREAGE ALLOTMENT

The starting point in the new program for wheat is the national wheat acreage allotment made annually.

Allotments are set to keep the Nation's wheat supply equal to a year's normal domestic consumption and export with 30 percent for reserve. This is about 100,000,000 bushels more than the average carry-over for the 1920's and is a safeguard against low yields resulting from unfavorable weather such as was experienced in the middle 30's. The foundation for the Ever-Normal Granary for wheat is laid in this manner.

The 1938 national wheat acreage allotment of 62,500,000 acres did not materially affect 1938 seedings by wheat farmers. A large part of the wheat for harvest in 1938 had been seeded when the new act became law. The allotment was made only for the purpose of computing payments to be made to farmers who complied with the general requirements of the 1938 conservation program.

The national allotment was broken down into State and then county allotments on the basis of the average acreage during the last 10 years, including acreage diverted under the adjustment and conservation programs, and with adjustments for abnormal weather and for trends. In the counties, the allotments for farms were made by county committees on the basis of tillable acreage, crop rotation practices, type of soil, and topography.

Before seeding for the 1939 crop began in the fall of 1938, the acreage allotment machinery was available for use. A high percentage of compliance resulted. Wheat farmers throughout the country reduced their seedings 19 percent under the 1938 figure. Although the 64,595,000 acres seeded to wheat exceeded the 55,000,000-acre allotment, preliminary estimates indicate that the acreage harvested in 1939 was about 54,000,000 acres.

THE WHEAT PROGRAM IN THE WESTERN REGION

Of the 62,500,000 acres in the 1938 national wheat allotment, 32,786,828 acres were allocated to the wheat farms in the Western Region. About 74 percent, or 24,200,000 acres, of the Region's wheat acreage allotment was included on participating farms. The number of application farms on which wheat allotments were established was about 281,000. From 40 to 45 percent of the payments made to farmers in the Western Region were for compliance with the 1938 wheat allotments.

THE WHEAT LOAN PROGRAM

The Agricultural Adjustment Act of 1938 provides for a wheat loan as a measure to give the wheat farmer greater freedom in marketing by enabling him to store his wheat when the price is low or the supply is excessive.

Loans are made only to cooperators in the program except when marketing quotas are in effect. Then loans would be offered to noncooperators at 60 percent of the rate to cooperators. Loans to noncooperators are made only on that part of their production that would be subject to a penalty if marketed. However, in years when the supply level is so high that marketing quotas would be applicable under the Act, loans are not to be made if more than one-third of the wheat farmers voting in a referendum are opposed to such marketing quotas.

The first loans under the 1938 loan program were made in August 1938. The deadline for filing applications was December 31, 1938. The loan rates offered farmers at individual points were calculated from basic rates established for the principal terminal markets with differentials for freight and handling charges for interior points.

Reports on the 1938 loan program show that approximately 85,700,000 bushels of wheat were stored under loan. The Commodity

Credit Corporation and other lending agencies advanced a total of approximately $49,000,000. Loans on about 3,900,000 bushels of wheat stored on farms were extended for a 10-month period to March 31, 1940. A total of approximately 15,700,000 bushels was turned over to the Commodity Credit Corporation in settlement of loans. The remainder of 66,100,000 bushels was redeemed by the borrowers. Most of the 15,700,000 bushels which was turned over to the Commodity Credit Corporation was sold to the Federal Surplus Commodities Corporation and added to the stocks available for export or distribution to relief agencies.

The 1938 loan program demonstrated the effectiveness of farm storage as part of the program. About 25 percent of the collateral was stored in approved granaries on farms of the borrowers. Only a very small percent of these loans had to be called because of wheat going out of condition. This record indicates that farmers fulfilled their responsibility of protecting the collateral from deterioration.

THE WHEAT EXPORT PROGRAM

The wheat export program operated as an important measure in the over-all national wheat program.

The wheat export program was launched in August 1938 as an emergency measure to hold for the United States a fair share of the world market for wheat. In 1938, the world had a record wheat crop. Importing countries which had taken as much as 950,000,000 bushels in 1928–29 were buying less than 600,000,000 bushels. In the face of this situation most of the exporting countries were adopting measures to help move their wheat into world trade.

Under the 1938–39 export program, the Federal Surplus Commodities Corporation purchased surplus wheat at the market price and sold the wheat to exporters at a price enabling them to compete for foreign markets.

From July 1, 1938, to June 30, 1939, approximately 118,000,000 bushels of United States wheat and flour were sold for export, of which 107,000,000 bushels were actually exported.

Of the total sales for export, the sale of about 94,000,000 bushels was assisted by the Federal export program. Of this, 70,000,000 bushels were grain and the remainder flour.

THE WHEAT MARKETING QUOTAS

The parts of the 1938 Act which provide for substantial wheat carry-overs recognize that crops may be short in some years and that preparations must be made for such an emergency. The act also recognizes that there may be emergencies caused by surpluses. For these emergencies the act provides marketing quotas. If in any year the total supplies, made up of the crop and carry-over, exceed 135 percent of a normal year's domestic consumption and exports, marketing quotas for that year are proclaimed by May 15, subject to approval of farmers voting in a referendum. No quota is effective for any crop unless two-thirds of the farmers voting in a referendum favor the quotas. If the supply situation changes after a quota is established, the quota may be increased, or suspended altogether, and in the event of a national emergency the quota may be suspended.

There was no 1938 wheat marketing quota, as the act provided that no quota for wheat would go into effect during that year unless parity payments were made available prior to May 15, 1938. Funds were not made available for these payments prior to that date.

On May 16, 1939, the available statistics of the Department of Agriculture indicated that the total supply of wheat for the 1939–40 marketing year would be 974,000,000 bushels. Later estimates indicated a total supply of 994,000,000 bushels.

The 1939 marketing quota level established under the act was 1,021,000,000 bushels, which is 135 percent of 756,000,000 bushels, a normal year's domestic consumption and exports. Since the total supply did not exceed the marketing quota level, no marketing quota for wheat in 1939 was proclaimed.

CROP INSURANCE PART OF EVER-NORMAL GRANARY FOR WHEAT

Working with the acreage allotment, loan, and marketing quota provisions, crop insurance [1] is an important part of the Ever-Normal Granary for wheat. Through the Federal Crop Insurance Corporation farmers may insure wheat yields against unavoidable hazards. In this way the farmers of the Nation can place wheat from a good crop year in the Ever-Normal Granary as a protection against the years when crops are poor.

The crop insurance provisions of the new act first became effective for the crop planted for harvest in 1939.

PROGRESS UNDER 1938 WHEAT PROGRAM

Although the new act did not become law until February 1938, wheat farmers made use of three parts of the farm program to improve their supply situation during 1938–39. These measures were the loan and export programs on their 1938 crop and the acreage allotments on seedings for the 1939 crop.

The year began with a carry-over of 154,000,000 bushels on July 1, 1938. This carry-over, together with the 1938 crop of 931,000,000 bushels, made a supply for 1938–39 of 1,084,000,000 bushels. This huge supply, which was about 375,000,000 bushels in excess of domestic consumption, continued the downward price trend begun under the pressure of the large 1937 crop and the mounting world supplies.

By the beginning of the 1939–40 crop year, United States wheat farmers had brought the supply more in line with domestic requirements, export outlets, and the reserve level provided under the Ever-Normal Granary. The 1939–40 supply of 993,000,000 bushels as estimated on October 1, 1939, was about 100,000,000 bushels below that for the previous year. Also the domestic price of wheat, in the face of the most depressed world wheat situation in history, has been as high as 35 cents above the normal relationship with the world level.

But prices received by growers during the time the loan and subsidy programs were in effect reflected not only a change in spread between domestic prices and prices in other countries, but also a change in the general wheat price level. For example, in August

[1] The crop insurance program is discussed in detail in ch. 2, beginning on p. 24.

1938, the average wheat price to United States growers was 51 cents when Liverpool was 85 cents, or the farm price in the United States was 34 cents below the market price at Liverpool. In May 1939, the price to United States growers averaged 63 cents and prices at Liverpool also averaged about 63 cents. The spread had changed about 34 cents in favor of the American wheat grower.

II. THE 1938 RANGE PROGRAM IN THE WESTERN REGION

About 14,200 applications for participation in the range conservation program were filed in the Western Region during 1938. These ranches covered an area of more than 88,000,000 acres of range land and 564,000 acres of mountain meadowland.

The number of acres which were examined in order to establish range-building allowances has steadily increased each year since the inauguration of the range program. The acreage increased from 49,039,000 acres in 1936, to 79,127,000 acres in 1937, to more than 88,000,000 acres in 1938, and to an estimated 112,393,000 acres in 1939.

From the standpoint of amount of payment earned, the construction of earthen tanks or reservoirs was the most important single practice in 1938. This practice accounted for an estimated total of 43 percent of the payments earned.

More than half the participating ranches contributed to restocking of the range with grass by carrying out deferred grazing. They earned more than a third of the range-building payments for this practice. About four times as much range land was reseeded artificially in 1938 as in 1936.

Practices which are growing in importance in the Western Region and which are continuing to receive greater emphasis from ranchers each year are those dealing with erosion and run-off control. While these practices are still in limited demand and only about 500 ranches in six States were improved by contour listing, furrowing, or subsoiling, the acreage of range land on which this practice was carried out has tripled each year of program operation.

A measure of the range program's effectiveness has been apparent in 1939. In many range areas where drought has been severe, the range program has played an important part in enabling ranchers to retain their livestock. Under similar weather conditions in 1934, many of the same ranchers were forced to sell and ship their breeding stock because of lack of feed and water.

III. SOIL-BUILDING PHASES OF THE PROGRAM

Under the 1938 program soil-building practices were carried out on more than 331,000 farms or on about 71 percent of the total number of application farms in the Western Region.

The most widely adopted practice was the seeding of legumes and grasses. More than 4,000,000 acres were seeded in the Western Region under this practice in 1938.

Next in importance from the standpoint of number of units carried out, participating farmers turned under green-manure and left cover crops on nearly 4,500,000 acres.

Other widely used practices during 1938 were:

Perennial grasses and legumes renovated on about 800,000 acres; summer fallow protected on about 5,800,000 acres; contour farming carried out on about 690,000 acres; contour or basin listing carried out on about 160,000 acres; forest trees planted or maintained on 22,036 acres; natural reseeding carried out on about 310,000 acres of pastures; and about 1,800,000 pounds of seed used in the artificial reseeding of pastures.

About 117,000 tons of straw, 40,000 tons of lime, 18,000 tons of superphosphate, and 19,000 tons of gypsum were applied under the program.

RESTORATION LAND

A total of 1,812,000 acres was designated in the Western Region in 1938 as restoration land,[2] which is cultivated land that should be restored to grass. Applications for payment covered practices carried out on more than 91 percent of this total.

SUGAR PROGRAM

More than 99 percent of all of the sugar-beet growers in the Western Region complied with the requirements of the sugar-beet program in 1938 and thereby became eligible for 1938 sugar-beet payments. There were a few growers who did not meet the farming-practice requirements and a small number who did not meet the wage-rate requirements.

Payments in connection with the 1938 sugar-beet program in the Western Region are nearly complete. A total of 28,389 applications had been forwarded to the General Accounting Office for payment as of September 30, 1939. These applications amounted to $15,848,000.

A total of about 620,000 acres of sugar beets was planted for harvest on participating farms in the Western Region in 1938. Payments were approved in connection with the abandonment of 21,472 acres because of crop failure.

Practices carried out in the Western Region under the 1938 sugar-beet program were: 456,033 acres of legumes or grasses maintained; 121,993 acres of legumes or grasses seeded; 104,143 acres of green-manure and cover crops seeded; 181,893 acres credited for application of animal manure; and 158,079 acres credited for application of commercial fertilizer.

IV. THE PROGRAM FOR OTHER CROPS

The diversity of crops in the 13 States of the Western Region called for the application of other phases of the A. A. A. than those dealing with wheat, the range, and general soil-building practices. However, most of these measures were applied only in comparatively small areas.

COTTON IN THE SOUTHWEST

In irrigated areas of California, Arizona, and New Mexico, cotton production is a new and developing industry. The chief concern

[2] The restoration land program is discussed in ch. 2, p. 19.

here is for a program that may reflect production trends while calling for the inevitable adjustments which must be made in the Nation's cotton production. In the 1938 act, allotments are based on recent periods and allowance is made for trends in production as a protection against arbitrary acreage restrictions in any area.

Eighty-seven percent of the total cotton allotment for the Western Region was on farms for which applications for payments were made.

CORN IN KANSAS

Provisions of the act dealing with corn were applied in the "commercial corn-producing" counties of Kansas. These provisions included acreage allotments and storage loans.

Application farms had 31 percent of the corn acreage allotment distributed to all farms in the commercial corn area in eastern Kansas.

RICE IN CALIFORNIA

Rice, in the Western Region, is a crop grown only in California. In general, the A. A. A. provisions for rice follow the outline of the provisions designed for wheat and corn, but apply to the special problems of rice farmers.

Seventy-three percent of the rice acreage allotment for the Western Region was represented on application farms.

TOBACCO IN KANSAS

The tobacco program affected a small area in Kansas, the allotment being 556 acres. Forty-two percent of this was on application farms.

POTATO PROGRAM

All but two States in the Region applied the potato program which utilized allotments as a means of stabilizing the acreage in commercial potato-producing areas. The allotment for the Region totaled 416,011 acres. About two-thirds of the potato allotment distributed to farms in the Western Region was represented on application farms.

CHAPTER 4

THE PROGRAM IN THE NORTH CENTRAL REGION

The North Central Region is composed of 10 Midwestern States, Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin. As a group, these States are characterized by fertile soil and a climate which makes them adaptable for food production of many kinds; by a topography adapted to comparatively large-scale and at the same time intensive farming; by a network of rivers, railroads, and highways which facilitates the exchange of agricultural and industrial products; by large cities, many of which are primarily concerned with the processing of products which come from or will be used on the farms. It is a region in which the interdependence of agriculture and industry is marked.

FARM PRODUCTS OF THE REGION

Agriculturally speaking, the Region is primarily noted for its Corn Belt, in which is produced about 65 percent of the Nation's corn supply. The Corn Belt, classified as the "commercial corn-producing area" by the Agricultural Adjustment Act of 1938, covers some 60 percent of the area in the Region and is the only area in the United States which produces surplus corn. The major portion of this corn is converted into pork, beef, mutton, and other meat products in the area, and often on the same farm on which it is produced. Three-fourths of the Nation's pork supply comes from the Corn Belt. The prices of corn and livestock products produced from corn are the determining factors in the economic welfare of the Region—both on the farm and in the city.

In the Lake States to the north of the Corn Belt is found the major dairy area of the Midwest and the chief butterfat-producing region of the United States. This area is economically dependent upon dairy enterprise with a smaller proportion of its income derived from general farming and truck gardening. Roughly 25 percent of the Nation's beet-sugar supply comes from the North Central Region.

To this dairy area of the Lake States the price of corn and the welfare of the corn farmer are extremely important, even though indirectly. A collapse of corn prices, followed by a decline in meat prices, causes corn farmers to seek other outlets for their grain. An expansion of the dairy enterprise in the Corn Belt is often the result.

West of the Corn Belt, in western South Dakota and Nebraska, grazing and wheat farming are the chief forms of agriculture. Here

again, particularly to the cattlemen, the price of corn and the ability of the corn farmer to stock his feedlots with western cattle are of primary importance. The stability of corn supplies and prices is a vital factor in profitable livestock production.

In the other parts of the North Central Region—southern Missouri and eastern Ohio—general farming is of chief importance. In several counties of southern Missouri, cotton is grown on a large scale. Tobacco is produced in several counties in Missouri, Illinois, Indiana, Ohio, Minnesota, and Wisconsin.

EXTENT OF DAMAGE FROM SOIL EROSION

The total area of farm land in the North Central Region is about 485,000,000 acres, of which about 4,000,000 acres are in mountains, mesas, and badlands. About 270,000,000 acres, or 56 percent of the total acreage in farm lands, have not suffered erosion to any great extent. Nevertheless this land not subject to erosion has suffered serious depletion from continuous overcropping, as has all the cultivated land of the Region. Better land-use, including longer rotations that provide protective covering, is imperatively needed to conserve this land.

Erosion has destroyed for tillage about 10,000,000 acres; another 40,000,000 acres have suffered severe erosion; in addition, 155,000,000 acres, or 32 percent of the total farm-land acreage, have been moderately eroded.

With land surface in the Region more continuously bared of a protective covering than ever before, erosion has become a more serious problem since the wartime expansion of crop acreages from 1914 to 1918. That overcropping greatly accelerates erosion is evidenced in the older farming areas of the United States, and a large percentage of the farm land in the North Central Region may soon be worthless for cropping unless farming practices are altered to combat erosion.

I. TRENDS IN CORN AND HOG PRODUCTION

The trends of corn and hog production since 1933 have had an important bearing on the development of the 1938 program in the North Central Region.

On January 1, 1933, there were 62,000,000 head of hogs on farms, the largest number since 1924, and one of the largest corn crops in our history had just been harvested from 110,000,000 acres. Prices of both commodities were near an all-time low. Removal of these price-depressing surpluses was the problem of the moment.

In both 1934 and 1935 about 1,000,000 corn-hog contracts were signed. In 1934 the contracts called for approximately 25 percent reduction in the production of corn and hogs. Drought, however, caused crop failure, brought heavy liquidation in livestock numbers, and completely altered the prospect for corn and hog producers. The number of pigs produced in 1934 was about 23,000,000 head less than the 1927–33 average and the corn crop amounted to only 1,400,000,000 bushels. Normal yields on the 1934 planted acreage would have yielded 2,200,000,000 bushels.

Under the 1935 contracts about 11,500,000 corn acres were contracted, but the contracts called for hog production about 15 percent larger than the 1934 contracts. Hog numbers on January 1, 1936, were 42,500,000 head, compared to 62,000,000 head 3 years before.

From 1932 to 1935 the average annual farm price of hogs had increased from $3.34 per hundredweight in 1933 to $8.63 in 1935, while the farm price of corn had increased from 28 cents to 58 cents per bushel.

The cash farm income from hogs alone increased nearly 60 percent from 1932 to 1936. In the fall of 1935 farmers voted 6 to 1 for a new program for the coming year.

But on January 6, 1936, the Supreme Court decision in the Hoosac Mills case invalidated the production-control features of the Agricultural Adjustment Act. In no program since 1935 has there been any provision to adjust hog supplies directly. A major shift was made in 1936 to a more direct conservation program under the Soil Conservation and Domestic Allotment Act of 1936.

The advisability for such a program in the Corn Belt is found in the recommendations of both county planning committees and State specialists. Both groups recommended shifts from corn and other major soil-depleting crops to hay and pasture, designed to check erosion and depletion and remove some of the poorer land from cultivation. County committees recommended that corn acreage be 14 percent lower than it might be expected to be without a farm program, and the State specialists suggested an acreage 20 percent lower. Both groups recommended a sharp increase in the acreages of soil-conserving crops.

Approximately 71 percent of the total cropland in the North Central Region was included in participating farms in 1936, and 16 percent of the total payments were made for carrying out soil-building practices. Ninety-three percent of the soil-building practices was the establishment of new seedings.

With another record-breaking drought in 1936, corn production was again a billion bushels short of what it might have been with normal yields on the planted acreage, and hog numbers were even further reduced by the forced liquidation in many parts of the western Corn Belt. The season's average price of corn passed the dollar mark for the first time since 1924, and the farm value of the year's crop, short as it was, was the highest since 1929. The farm price of hogs was also the highest since 1929.

The average annual acreage of corn in the United States in the period 1928-32 was about 103,400,000 acres. The acreage harvested in 1936 was 93,020,000 acres. The corn acreage goal for 1937 under the conservation program was set at about 94,137,000 acres. However, the drought experience of 1936 and the relatively high prices at which the short 1936 crop was harvested caused noncooperating farmers to expand their corn acreage considerably in 1937. The planted acreage that year amounted to about 96,500,000 acres and the crop itself amounted to 2,651,000,000 bushels, whereas it had been calculated that a crop of 2,300,000,000 bushels would be adequate for feed requirements and a substantial carry-over.

Under the program, however, more than 8,000,000 acres of cropland in the North Central Region were diverted from soil-depleting to soil-conserving crops and uses. Also, farmers in the North Central Region earned payments for establishing nearly 16,000,000 acres of new seedings in 1937.

Consequently, it was with a surplus of cheap corn, and with hog numbers responding to the favorable feeding ratio by rapid increases, that the Agricultural Adjustment Act of 1938 went into operation in the North Central Region.

In addition to surplus corn and rapidly increasing hog numbers, other factors had to be taken into consideration in the first year of operation under the new farm act in 1938 in the North Central Region.

TECHNOLOGICAL ADVANCEMENTS

From the standpoint of farm equipment, the advancements of the last few years have been of great importance to Corn Belt farmers. The development of the all-purpose tractor has greatly increased farming efficiency and made it possible for the farm operator himself to tend constantly larger acreages. Likewise, improved field equipment of other kinds is making it possible for the average Corn Belt operator to farm his land more intensively than in the past. He finds it possible to prepare better seed beds, to carry out the various farming operations at more nearly the most opportune time—in general, to do a better job of farming. The average Corn Belt farmer is better equipped to exploit his land than he was previously. In other words, by expending the same energy he is able to produce bigger yields on larger acreages, thereby more rapidly depleting the soil.

The use of hybrid seed corn is also a large contributing factor to this same situation. It is estimated that 30 percent of the corn grown in the Corn Belt in 1938 was from hybrid seed which increased yields by from 7 to 15 percent. In 1939, 43 percent of the corn production of the Corn Belt was grown from hybrid seed. In 1938 half the corn in Iowa originated from hybrid seed, and in 1939 this was increased to 75 percent. Here again the farmer is confronted not only with the pressure of constantly expanding supplies, but also with the increased soil depletion accompanying bigger yields.

A similar situation prevails with respect to the production of hogs. During the last 15 years the number of pigs saved per litter has increased from five and one-fourth to six and one-third. This is a 20 percent increase in efficiency.

These marked increases in the efficiency of corn and hog production are of great significance and benefit, yet they intensified some of the older problems of the Corn Belt farmer. Consequently, it was in the face of rapid technological advancements in both major Corn Belt commodities, as well as with superabundant supplies of corn, that the new farm act faced its first year of operation in the Middle West.

II. CORN AND THE 1938 ACT

The corn acreage goal for the United States under the Agricultural Conservation Program for 1938 was 94,000,000 to 97,000,000 acres. In

line with this goal, the Secretary of Agriculture established a corn allotment of 40,500,000 acres for the commercial corn-producing area. This allotment was in turn apportioned among the corn farmers of 566 commercial corn counties in 12 States on the basis of their previous corn acreage and the fertility and topography of the soil.

For the purpose of establishing this national allotment, a normal year's domestic consumption and exports of corn was determined to be 2,393,000,000 bushels and the reserve supply level was determined to be 2,632,300,000 bushels. It was estimated that the carry-over at the beginning of the 1938–39 marketing year would be 340,000,000 bushels and that the production of corn needed from the commercial corn-producing area was 1,284,000,000 bushels.

For the 10-year period, 1928–37, the average annual planted acreage in the commercial area had been 49,205,242 acres. In 1937 the planted acreage for the commercial area had mounted to 47,102,450 acres, roughly 7,000,000 acres above the 1938 allotment. However in 1938, under the new act, farmers in the commercial area adjusted their plantings to 43,184,270 acres, somewhat above the allotment but sharply under the 1937 acreage. The 1938 average yield for the commercial area was 34.3 bushels per acre, compared to the 10-year (1924–33) pre-drought average of 31.7 bushels per acre. The actual yield resulted in a 1938 total production for the commercial area of 1,559,689,276 bushels.

For the United States as a whole, the 1938 planted acreage was 93,257,000 acres compared to the national A. A. A. goal of 94,000,000 to 97,000,000 acres. The 1938 country-wide yield was, for the second consecutive year, abnormally high at 27.7 bushels per acre. The 1924–33 average was 24.8 bushels per acre. The production for 1938 was 2,542,000,000 bushels or some 160,000,000 bushels more than might have been produced at normal yields on the acreage allotments. However, the crop was nearly 300,000,000 bushels smaller than would have been produced on the average corn acreage.

III. CORN LOANS

With the total 1939 supply of corn at approximately 2,900,000,000 bushels, and hog numbers still nearly 5,000,000 head under the 10-year (1928–37) average, corn loans became increasingly important in the fall of 1938.

Corn Belt farmers have had much experience with Federal corn loans. The first corn loan was made in the fall of 1933, when some 271 million bushels of corn were put under seal as farmers took advantage of the 45-cent per bushel loan in preference to selling on a depressed market. The 1933 corn loan marked the beginning of the Ever-Normal Granary that farmers of the United States now value so highly. Since that time some corn has been placed under Government loan each year, with the total up to the fall of 1938 being some 370,000,000 bushels. Of that 370,000,000 bushels, all but about 27,000,000 bushels have been redeemed or placed under renewal loans by farmers at the time the various loans have fallen due.

In 1937 about 46,000,000 bushels of corn were stored as collateral for a 50-cent per bushel loan from the Commodity Credit Corporation. These loans were due on November 1, 1938. On August 27, 1938, with the farm price of corn still below the loan rate of 50 cents per bushel, and prospects good for a large 1938 crop by that time, a loan renewal program was offered to those farmers who had corn under seal. Farmers were given the choice of turning their corn over to Commodity Credit on November 1, or resealing it until the following August 1 at 57 cents per bushel. The majority chose to reseal their corn at the 57-cent rate, and nearly 30,000,000 bushels thus remained on the farms during the following winter and summer.

In accordance with the specifications laid down in the Agricultural Adjustment Act of 1938, the loan rate on 1938 corn was determined to be 57 cents per bushel on farm-stored corn in the commercial corn area. Outside the commercial corn area loans were available to cooperators at 75 percent of the rate in the area, or 43 cents per bushel. In all cases loans were available only to those farmers who had planted within their corn acreage allotments or within their total soil-depleting allotments if outside the commercial area.

Loans became actually available to farmers in early December 1938 and continued to be available until March 1, 1939. During this time loans were negotiated, either through Commodity Credit or local banks, on more than 227,000,000 bushels of the 1938 corn crop. The average loan was on 1,000 bushels of corn for $570 bearing 4 percent interest and due on August 1, 1939.

Under the present act corn loans are offered to cooperators every year if the crop is greater than a normal year's domestic needs and exports, or if the farm price of corn falls below 75 percent of parity. The act forbids loans, however, if marketing quotas are rejected in a producer-referendum. If marketing and storage quotas are in effect, loans are offered to cooperators in the area at the full rate, and to noncooperators in the area at 60 percent of the full rate and only on the amount they are required to store.

IV. THE RANGE PROGRAM

The range program applies to two of the States in the North Central Region, South Dakota and Nebraska, both of which contain large areas devoted almost entirely to livestock grazing. This program has been very popular with ranchers.

Most of the western half of South Dakota consists of range land and the State ranks second only to Texas in the number of range program participants. More than one-fourth of the participating ranch land in South Dakota was reseeded naturally by deferred grazing under the 1938 program. Other popular range-conservation practices in the State were artificial reseeding of grass land, construction of spreader dams and terraces to control erosion, and development of springs as sources of stock water.

Nebraska, with grazing land over most of the northwestern third of its area, also benefited extensively by deferred grazing to reseed depleted pasture. The State was second to Texas in drilling or

digging wells as stock watering places, and planted a larger acreage of forest trees than any other State participating in the range program.

The range program, in three years of operation, has been a large factor in restoring grass in the range area following the droughts of 1934 and 1936.

V. SOIL-BUILDING PRACTICES

Relatively small areas in the North Central Region are subject to gully erosion, and most of the flat, fertile farms will produce legumes without the application of commercial fertilizer. Those factors, along with the need for considerable amounts of roughage, make the seeding of legumes by far the most important soil-building practice in the North Central Region.

Under the 1938 program more than 13,000,000 acres were seeded to alfalfa, sweet clover, red clover, and other legumes and grasses in the 10 States of the North Central Region. This is an area greater than all the cropland in Indiana. Green-manure and cover crops were used on more than 148,000 acres.

In some areas application of limestone as fertilizer is a major soil-building practice. More than 500,000 tons of limestone were spread in Illinois alone in 1938; and for the entire Region, more than 1,700,000 tons of limestone were applied.

More than 63,000 acres of trees were planted or improved under the 1938 program in the North Central Region.

Erosion-control practices of the Region are highly varied, with maintenance of protected summer fallow, strip cropping, and contour farming and listing being carried out extensively in several States, especially in the western part of the Region, which is subject to wind erosion.

VI. GENERAL PROGRESS ON 1939 PROGRAM

The 1939 farm program, virtually the same as the 1938 program so far as the North Central Region was concerned except for the addition of parity payments, was available to Corn Belt farmers at least 4 months earlier in the year than was the 1938 program. By the middle of January 1939, county and community committeemen had received instructions and the forms necessary for the execution of the first step in 1939 compliance—the completing and signing of the Farm Plan for Participation in the 1939 Agricultural Conservation Program. The deadline on signing the farm plans was May 1.

By the first of May, 1,620,000 farm plans had been signed in the 10 States, representing, for all practical purposes, that many farms. That number represented approximately 74 percent of all North Central farmers and 83 percent of all cropland, an increase of 30 percent over participation in 1938.

This increase was accounted for, at least partially, by the fact that farmers found the program more simple as they became better acquainted with it, by the more effective educational work which com-

mitteemen were able to carry on, by the parity payments available for the first time in 1939, and by the distinct advantage which farmers found in the 1938 corn loans. There was also more indication than ever before that farmers were appreciating the necessity of conserving the soil and making acreage adjustments.

It was significant that many corporate landowners, even though barred from receiving full conservation payments under the $10,000 limitation of the Soil Conservation and Domestic Allotment Act, did encourage their tenants to participate in the program.

As in previous programs, the signing of farm plans for participation in the 1939 program indicated a wide variation in participation between various States and sections in the Region. Below is a tabulation of the number of farm plans signed, the percent of farms in the State for which farm plans were signed, and the percent of cropland in the State covered by the number of farm plans signed:

State	Number of farm plans signed	Percent of all farms	Percent of cropland covered
Illinois	179, 607	66	77
Indiana	138, 681	63	73
Iowa	192, 835	84	90
Michigan	155, 842	75	79
Minnesota	180, 862	81	88
Missouri	205, 717	72	79
Nebraska	123, 717	72	81
Ohio	154, 976	59	71
South Dakota	110, 249	87	94
Wisconsin	177, 938	88	92
North Central Region	1, 620, 424	74	83

VII. CORN UNDER THE 1939 PROGRAM

The act specifies that the commercial corn area shall include all counties producing an average of at least 450 bushels of corn per farm and 4 bushels of corn per acre of farm land during the last 10 years. It also includes bordering counties in which there are minor civil divisions likely to meet those requirements during the year.

In accordance with those specifications, 586 counties were included in the commercial corn-producing area for 1939. This was an increase of 20 counties over 1938, the additional counties being mostly along the northern and eastern edges of the area.

The national corn acreage allotment for this area also was increased from 40,500,000 acres in 1938 to 41,250,000 acres in 1939. This figure was reached on the basis of a determination showing a normal year's domestic consumption of corn to be 2,349,000,000 bushels, a normal year's exports to be 70,000,000 bushels, and a carryover estimated to be 395,000,000 bushels.

On the basis of these figures the reserve supply for 1939 was set at 2,660,000,000 bushels, 1,310,000,000 bushels of which would be produced in the commercial corn area at normal yields of 31.8 bushels per acre.

Following is a comparison between the 1938 and 1939 State corn acreage allotments and the number of counties designated in each State as being commercial corn counties in each of the 2 years:

State	1938		1939	
	Number of counties	Acres	Number of counties	Acres
Illinois	102	7, 348, 375	99	7, 308, 282
Indiana	77	3, 456, 203	82	3, 583, 191
Iowa	99	9, 249, 232	99	9, 274, 903
Kansas	27	2, 108, 595	25	1, 983, 137
Kentucky	4	154, 764	8	270, 915
Michigan	5	223, 790	11	411, 092
Minnesota	45	3, 319, 794	45	3, 316, 151
Missouri	63	3, 267, 079	63	3, 301, 517
Nebraska	64	6, 757, 334	64	6, 876, 354
Ohio	57	2, 521, 771	61	2, 646, 953
South Dakota	17	1, 635, 790	17	1, 525, 516
Wisconsin	6	452, 809	12	741, 648
Total	566	40, 495, 537	586	41, 239, 659

The State allotments for the 2 years listed here are not strictly comparable, since having the same number of counties in a State both years does not necessarily mean the same counties are included both years.

CHAPTER 5

THE PROGRAM IN THE SOUTHERN REGION

The fundamental need for a farm program in the Southern Region, composed of the nine States of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, South Carolina, and Texas, is based upon the necessity for a larger farm income. The South has the lowest farm income of the major farming regions in the United States, its farm population is the densest, and it therefore follows that the per capita return from the land is the smallest. As an example, the average income per person on farms in 1935 for the United States as a whole was $268, while the average for the South was about $100 less.

Heavy soil losses account in part for the South's low income. Much of the land in the South has a topsoil that is comparatively shallow and not rich in mineral and organic plant food. Most of the land is rolling and subject to rapid erosion by water run-off unless protected. Rainfall in most of the Region is heavy, particularly during the season when the land is not protected by vegetation. In the drier areas of the Southwest, wind erosion takes a heavy toll of soil. There are no universally adapted perennial or biennial legumes in the South and in order to keep a cover of vegetation on the land throughout the year it is necessary in most cases to plant two crops, a winter cover crop and a summer cover crop. Most of the seed for winter cover crops must be imported from outside the Region and paid for in cash. As a rule, the winter cover crops grown in the South are not used for hay, nor for grazing, but are turned under to enrich the soil. Intertilled crops in the Region result in heavy soil losses.

The density of farm population in the South tends to encourage row cropping. Farms are relatively small and the competition for the land is sharp. Concentration on the land results in intensive land use, with emphasis on cash crops such as cotton, tobacco, and truck crops. Furthermore tenancy is high, 61 percent in the nine States of the Southern Region as compared with 42 percent for the country as a whole, and about one-third of the tenants move every year. Soil mining and poor housing are the result of this system. Landlords and a mobile tenantry alike show preference for farming operations that result in the largest cash income, especially cotton production.

Production of food and feed for home use contributes too little to the farm income of the South. The 1935 farm census revealed that in the 9 States of the Southern Region, there were 638,000 farms without milk cows, 800,000 farms without hogs, 293,000 farms without chickens, and 1,637,000 farms without any kind of plowable pasture. Associated with this deficiency in production for home use is an

inadequate diet. A serious health problem in the Southeast also is related to the lack of adequate diet and farm income.

The South's farm income is dependent to a marked degree upon a single crop—cotton. Cotton is grown on about 2,000,000 farms in the southern States, of which 1,640,000 are located in the 9 States of the Southern Region. Some 10,000,000 people live on cotton farms, of which over 8,000,000 are in the Southern Region. This means that approximately one-third of the Nation's farm population is dependent wholly or in part upon cotton for a living. The loss of a portion of our export outlets, which formerly took a large part of the cotton production, struck with disastrous effect at the South's farm income. A shift in the South's farm economy to lessen the dependence upon cotton production is needed. However, such a shift must of necessity be a gradual one, and while it is under way farm income must be maintained. This has been done with the assistance of the Agricultural Adjustment Administration program. For the 10-year period, 1920 to 1929, income from cotton and cottonseed averaged $1,370,000,000 annually. During the 3 depression years, 1930–32, it dropped to an average of $580,800,000. During the 6 years that the adjustment programs have been in effect, income, including payments to farmers under the program, averaged a little less than $900,000,000.

In the Southern Region provisions of the Agricultural Adjustment Act of 1938 affected mainly cotton, tobacco, wheat, rice, peanuts, and potatoes, with special provisions covering soil-building and range-building practices.

I. COTTON IN THE FARM PROGRAM

The A. A. A. program for cotton aims to accomplish four main objectives: First, to supplement income of cotton producers through conservation and price-adjustment payments and to do away with periodic price slumps by reducing the surplus and adjusting production more nearly in line with demand; second, to make more land available for food and feed crops to be used on the farm; third, to attack soil-depletion and erosion losses by providing cover crops and by other soil-building and conserving practices; fourth, to expand domestic consumption and exports.

To accomplish these objectives, the program operates in several parts—the conservation phase, with acreage allotments and payments for conservation accomplished; marketing quotas, which may be used to prevent noncooperators from getting an unfair share of the available markets; and the moving of surplus farm commodities into consumption channels. Under the 1938 conservation program, farmers received payments for planting within their acreage allotments and for carrying out approved soil-building and conserving practices, such as planting cover crops and building terraces. Parity payments on cotton also were based on compliance with the soil-conservation feature of the program. Provision is made that marketing quotas are to be used when approved by vote of cotton producers in years when the supply of cotton becomes excessively large. This is the control feature of the program. The object is to keep the supply of cotton in line with normal carry-over, domestic consumption, and export demands.

The vote on quotas for the 1938 crop took place on March 12, 1938. A total of 1,527,028 cotton producers cast ballots, out of an estimated total of 2,300,000 eligible to vote. The result: 1,406,088 voted in favor of quotas, and 120,940 against. This was a majority of 92.1 percent for cotton marketing quotas. The Agricultural Adjustment Act requires a two-thirds majority for quotas to become effective. All farmers who grew cotton in 1937 were eligible to vote. The referendum was conducted by the county committees of the Agricultural Conservation Program, with local farmers in charge of the election.

THE NATIONAL COTTON ALLOTMENT

The national cotton allotment for 1938 was an acreage which, with normal yields, would produce 10 million bales, plus the additional acreage required to bring farm allotments up to certain minimums established by the act. This gave a total national allotment of 28,285,572 acres—the maximum acreage that could have been allotted. However, due to the fact that some farms could not qualify for minimum allotments and other farms were out of cotton production in 1938, the total allotment to individual farms was about 27,500,000 acres. The actual harvested acreage in 1938 was about 24,248,000 acres. In other words, producers actually grew about 3,250,000 acres less cotton than they were allotted under the program. The 1938 cotton allotments to individual farms by States were as follows:

Alabama	2,221,829	Mississippi	2,668,819
Arizona	197,595	Missouri	388,055
Arkansas	2,403,094	New Mexico	112,151
California	402,472	North Carolina	999,477
Florida	83,707	Oklahoma	2,283,692
Georgia	2,181,525	South Carolina	1,369,462
Illinois	5,447	Tennessee	821,854
Kansas	996	Texas	9,998,876
Kentucky	19,007	Virginia	57,472
Louisiana	1,246,996		

Marketing quotas were established for all cotton farms. The farmer could sell up to the amount of his quota without penalty, but had to pay a penalty of 2 cents per pound on marketings in excess of his quota. For the first 11 months of the marketing year which began August 1, 1938, penalties totaling approximately $780,000 were collected from farmers who sold cotton in excess of their quotas.

The conservation payment on cotton under the 1938 program was 2.4 cents per pound on the normal yield of each farm's cotton acreage allotment. Farmers knowingly overplanting their 1938 cotton allotments were not eligible to receive price-adjustment payments from the appropriation of $130,000,000 provided by Congress for cotton produced in 1937, these payments having been conditioned on compliance with the 1938 Agricultural Conservation Program.

The Agricultural Adjustment Act of 1938 provided for commodity loans under special conditions and a loan program was established for cotton. Producers complying with their cotton allotments were eligible for loans on all of the cotton produced on their allotted acres; those knowingly overplanting were eligible for loans only on cotton produced in excess of their marketing quotas and then at only 60 percent of the loan rate allowed cooperators.

Provision is made under the program for continuation of investigations for the development of new uses for cotton and other agricultural products through diversion of surplus products from the regular channels of trade and through the establishment of regional laboratories for experimentation. One of the laboratories is being located in New Orleans and development of new uses for cotton will be one of its major activities.

COTTON LOANS AND PRICE ADJUSTMENT PAYMENTS

The change from specialization in cotton production to a balanced system of agriculture entails a cost of time and money that the generally impoverished cotton grower cannot meet. Conservation payments under the Agricultural Conservation Program help to meet the actual costs of rebuilding soil.

The Agricultural Adjustment Act of 1938 provides for loans to cotton producers when the price is abnormally low or the crop abnormally large, and the rate may vary between 52 and 75 percent of parity. For this Region a total of $168,876,943 was loaned on 3,711,966 bales of 1938–39 cotton. The basic rate for loans was 8.3 cents per pound on seven-eighths inch middling cotton, but loans were made at rates between 5.3 cents and 10.75 cents, according to the grade and staple of the cotton offered as collateral.

This was lower than the 1937–38 rate of 9 cents and the higher rates of 1935–36 and 1936–37, but it took into recognition the fact that an excessively high loan rate in relation to market price prevents the movement of cotton into export trade.

Price-adjustment payments were provided for in connection with the 1937 crop to supplement the income of cotton growers. From an appropriation of $130,000,000, payments totaling more than $103,000,000 were made in the Southern Region on about 1,155,000 applications. Payments were made to individual producers on 60 percent of their base cotton production as established under the 1937 program so as to assure, insofar as possible, those who cooperated in the 1938 Agricultural Conservation Program an average return of 12 cents per pound for their cotton produced in 1937.

AVERAGE OF 11 MILLION ACRES RELEASED TO SOIL-CONSERVING CROPS AND FOR FOOD AND FEED USES

The gains that have been made in soil conservation are shown in a number of ways. From 1933 through 1938, under 6 years of the adjustment programs, the average cotton acreage was 11,000,000 acres less than the average for the 10 years preceding 1933. This means that an average of 11,000,000 acres formerly in cotton was released for soil-conserving crops each year. Most of the acreage released from cotton was in the nine States of the Southern Region. In 1938, the United States cotton crop was grown on 24,248,000 acres, compared with an average of approximately 40,000,000 acres for the 10-year period preceding agricultural adjustment.

II. THE PROGRAM FOR OTHER CROPS

In addition to cotton, the 1938 program in the Southern Region carried special provisions for tobacco, rice, peanuts, wheat, potatoes,

and other soil-depleting crops grouped as "general crops." Acreage allotments were established for these crops in applicable areas and payments were made to cooperating farmers who planted within their allotments.

TOBACCO IN THE SOUTHERN REGION

Tobacco acreage allotments in Southern Region States for 1938 were as follows:

Flue-cured—Alabama, 400 acres; Florida, 13,700; Georgia, 83,000; South Carolina, 95,000 acres.

Burley—Alabama, 188 acres; Arkansas, 75; Georgia, 175; Oklahoma, 7; South Carolina, 125 acres.

Georgia-Florida Type 45—Florida, 818 acres; Georgia, 307 acres.

Georgia-Florida Type 62—Florida 2,349 acres; Georgia, 551 acres.

A referendum was held on March 12, 1938, to determine whether or not marketing quotas were to be in effect in 1938 for flue-cured tobacco. The vote in all States growing flue-cured tobacco, including the Southern Region, was 219,842 in favor of quotas and 35,253 against—a favorable majority of 86.2 percent. Under the program a two-thirds majority of those voting was required to put quotas in effect. The percentages in favor of quotas in the Southern Region States were: Alabama, 100 percent; Florida, 56.6 percent; Georgia, 62 percent; South Carolina, 89.7 percent.

A referendum was held on April 9, 1938, to determine whether or not marketing quotas for Burley tobacco were to be in effect in 1938. The total vote in all Burley States was 154,208 in favor of quotas and 22,870 against, a favorable majority of 87.1 percent. A two-thirds majority was all that was required. The percentages in favor of Burley quotas in the Southern Region States were: Alabama, 100 percent; Georgia, 95.3 percent; South Carolina, 100 percent; Arkansas, 100 percent.

The supply situation for Georgia-Florida Types 45 and 62 tobacco was such that referendums on quotas were not required.

Farmers received individual acreage allotments and quotas for tobacco. Under the conservation part of the program the payment on flue-cured tobacco was 1 cent per pound on the normal production of the producer's acreage allotment; the payment on Burley tobacco was one-half cent per pound; on Georgia-Florida Type 45, 1 cent per pound; on Georgia-Florida Type 62, 1.8 cents per pound. A producer could sell up to his quota of flue-cured or Burley tobacco without penalty; on all marketings in excess of his quota he was required to pay a penalty of 50 percent of the market price at the time of sale, or 3 cents per pound, whichever was greater.

PEANUT ALLOTMENTS IN COMMERCIAL AREAS

The program for peanuts in 1938 applied only to designated commercial peanut counties, as follows: Alabama, 9 counties; Florida, 2; Georgia, 32; Oklahoma, 1; Texas, 9 counties. The State peanut acreage allotted: Alabama, 246,851 acres; Florida, 47,383; Georgia, 454,667; Oklahoma, 18,121; Texas, 131,376 acres. Individual farms in the designated counties received peanut acreage allotments, with payments for planting within their allotments. The payment rate for peanuts was 20 cents per hundred pounds, on the normal production of the peanut acreage allotment.

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RICE ALLOTMENTS

Three States in the Southern Region received rice acreage allotments in 1938 as follows: Arkansas, 155,728 acres; Louisiana, 412,039; Texas, 167,272 acres. Rice acreage allotments for individual farms were established and farmers complying with the program received a payment of 12.5 cents per 100 pounds on the normal production of the allotment.

COMMERCIAL POTATO AREAS IN FIVE STATES

The 1938 program applied to Irish potatoes in designated commercial potato counties. Five States in the Southern Region had designated commercial potato counties, as follows: Alabama, 1 county; Florida, 9; Georgia, 1; Oklahoma, 3; South Carolina, 7 counties. The State potato allotments were: Alabama, 1,866 acres; Florida, 17,372; Georgia, 482; Oklahoma, 5,267; South Carolina, 10,324 acres. The payment rate on potatoes was 5.4 cents per bushel on the normal production of the potato allotment.

WHEAT AND GENERAL CROP ALLOTMENTS

Wheat in 1938 was included in the general crop allotments in the Southern Region. General crop allotments were as follows: Alabama, 4,933,450 acres; Arkansas, 3,929,864; Florida, 1,078,013; Georgia, 5,987,226; Louisiana, 2,451,906; Mississippi, 4,290,788; Oklahoma, 12,142,986; South Carolina, 3,417,725; Texas, 19,032,489. In wheat areas, individual farms received wheat allotments for the purpose of computing payments, but wheat acreages were not measured separately from the general allotments. The payment rate was 12 cents per bushel on the normal production of the wheat allotment. In Oklahoma, Texas, and parts of Arkansas, payment was made on general crops at a specified rate per acre. No payment was made on general crops in the remainder of the Region.

III. SOIL-BUILDING PHASES OF THE PROGRAM

To make it possible for farmers to obtain the maximum benefits from the land released from cotton and other soil-depleting crops, the program offered assistance for three types of soil-conserving practices. These were: First, soil-building crops, grasses, and forest trees; second, fertilizers to be applied to certain crops or grasses; third, terraces and other soil-conserving devices.

Assistance was given, in the form of soil-building payments, for practically all of the adapted legumes. Annual summer legumes, for example, could be interplanted with depleting crops, the seed harvested and the vines grazed; they could be planted alone and turned under as a manure crop; or they could serve as a strip crop, in which case the seed or hay could be harvested. The seeding of practically all suitable annual winter legumes qualified for assistance within the maximum payment for soil-building. Sorghum, which is usually considered soil-depleting, could qualify for assistance when used in such a manner as to promote soil conservation. In complying with the 1938 program, farmers of the Southern Region

planted 17,457,685 acres to green-manure and cover crops, of which 9,710,012 were planted to summer legumes.

Assistance for the planting, sodding, or restoration of grasses was largely limited to pasture land. This practice fitted the almost universal need for permanent pastures in the Region. Certain grasses also could be used in strip cropping as a soil-conserving practice. The growing of suitable legumes in pastures also qualified for assistance under the soil-building phase of the program. New seedings of grasses and biennial or perennial legumes made in complying with the 1938 program totalled 3,943,489 acres. Pasture practices were carried out on 238,097 acres. In reseeding, 1,203,800 pounds of seed were used.

The planting of forest trees, including post-producing trees, was approved as a soil-building practice, provided a good stand was obtained and the trees were properly cultivated. The proper maintenance of trees set under the provisions of any of the agricultural conservation programs during or since 1936 was also an approved practice for which assistance was provided. Forest tree practices under the program were carried out on 55,911 acres.

Application of superphosphate, basic slag, or rock phosphate was another way in which soil conservation was promoted through the program. These materials are considered soil-building when applied to soil-conserving crops, to certain grasses, or to permanent pasture. Lime or limestone could be applied to any cropland as a soil-building practice. These materials increase the growth of soil-conserving crops, grasses, or pastures, and thereby increase their value in conserving soil. A total of 145,254 tons of limestone and superphosphate was applied.

To hold the soil and keep it from washing away, and thereby to make sure that cropland will be kept productive in future years, the program offered assistance for terracing. Ridging and listing or furrowing noncrop open pasture land were also approved practices for which payments were made. The extent to which these practices were carried out in the Southern Region is shown in tabulations in the appendix.

$22,724,000 EARNED BY SOIL-BUILDING PRACTICES

Most of the practices were designed not only to improve the land, but also to promote the raising of more food and feed crops for home consumption on land released from cotton. The assistance offered for soil-building practices was to give the farmer the means of carrying out more of such practices than he otherwise would have been able to finance. Under the 1938 program a total of about $22,724,000 was earned in carrying out soil-building practices. The following table shows the amounts earned by farmers of the nine Southern Region States:

State:	*Approximate total actually earned*
Alabama	$3,091,000
Arkansas	2,406,000
Florida	2,141,000
Georgia	3,462,000
Louisiana	1,691,000
Mississippi	2,966,000
Oklahoma	$955,000
South Carolina	1,919,000
Texas	4,093,000
Total Southern Region	$22,724,000

The fact that yields of cotton have shown substantial gains in the Southern Region since the programs started indicates that the soil-building features of the program are proving effective. The release of millions of acres from soil-depleting crops has given farmers an opportunity for a beneficial rotation that has improved a great many farms to a marked extent. It has also given farmers a chance to rest their poorer acres from soil-depleting crops and make a start toward rebuilding the fertility of such areas. In view of the high proportion of run-down and seriously eroded land in the South, this is a significant step. The figures by States tell the story of what has happened to cotton yields:

Yields of cotton by States in Southern Region, 1923–32, 1936, 1937, and 1938

State	Cotton yields per acre (pounds)			
	10-year average 1923-32	1936	1937	1938
Alabama	173	236	290	251
Arkansas	189	249	328	304
Florida	125	170	162	163
Georgia	178	228	270	203
Louisiana	194	260	337	289
Mississippi	193	305	377	322
Oklahoma	150	62	156	163
South Carolina	206	279	289	249
Texas	138	121	197	168

22,700 RANCHES PARTICIPATE IN RANGE PROGRAM

The 1938 range program in the Southern Region was applicable in Oklahoma and Texas, with conservation of soil on range land as the chief aim. The program was designed to help ranchers put into operation the range-building practices which experiments and actual use have shown to be of value in helping maintain or restore a good stand of grass on depleted areas. The approved practices under the 1938 program sought to do this by eliminating range-destroying plants or by preventing erosion or, in the more arid areas, by the conservation of water. A maximum payment that a rancher could earn by carrying out range-building practices was established on each participating ranch. The main practices were: Natural reseeding by deferred grazing, development of stock water on range land, construction of tanks and reservoirs, construction of dams, development of natural watering places, erosion and run-off control, and elimination of destructive plants. As in the case of the soil-building payments in other areas, the payments under the range program were to assist ranchers in carrying out more range-conservation practices than they otherwise would have been able to carry out.

Range improvements under the program were carried out on 22,700 ranches in Texas and Oklahoma, and the land in these ranches totaled 78,803,000 acres, with a grazing capacity of 4,870,300 animal units.

IV. PARTICIPATION AND PAYMENTS TO FARMERS

Approximately 1,400,000 applications, representing approximately 2,400,000 individual farmers, were paid under the 1938 program in the Southern Region. These applications covered about 88 percent of all cropland in the Region. The payments totaled about $180,000,000. This included all payments on cotton, tobacco, wheat, peanuts, rice, potatoes, and general crops, plus the amounts paid to farmers of the Region as assistance for carrying out soil-building and conserving practices. In addition, approximately 1,155,000 applications for cotton price-adjustment payments, totaling more than $103,000,000, were paid in the Southern Region in 1938.

Farmers of the Southern Region have also shared with the producers of the wheat belt in the benefits of the crop insurance program which swung into operation in 1938 and paid its first loss checks in the first part of 1939. This feature of the program proved particularly effective in Texas and Oklahoma, where the Region's only large-scale wheat farming is located.

Another feature of the program of which farmers of the Region were beginning to take advantage on a large scale in 1938 was that under which superphosphate, limestone, and legume seed are furnished as grants-of-aid as an offset against their future A. A. A. payments. During the year, approximately 2,200 tons of superphosphate went to participating farmers, mainly in Alabama. Approximately 1,000,000 pounds of legume seed, mainly Austrian winter peas, went to Georgia farmers in 1938 as grants-of-aid, and plans for the use of limestone under the same program were launched on a large scale in South Carolina.

The farm program was particularly effective in the South, as a means of bringing about a better appreciation of the value of a united effort to solve farm problems. Each State and county was covered thoroughly with farmer meetings in connection with the cotton and tobacco referendums early in 1938, and every effort was made by the county and local committees, the county Extension agents, vocational teachers, and other farm leaders interested in improving Southern farm income, to acquaint all farmers with their basic problems and how they could cooperate to solve them. The referendums, the elections of committees of farmers by farmers, and the frequent contact of all participating farmers with their committeemen, county agents, and administrative assistants, were giving farmers a better appreciation of the democratic principles on which the program is founded.

CHAPTER 6

THE PROGRAM IN THE EAST CENTRAL REGION

The East Central Region, which is one of the oldest agricultural areas in the United States, includes a widely diversified agriculture. Among the important commodities are tobacco, cotton, corn, wheat, cattle, dairy products, poultry, vegetables, and apples. More than 60 percent of the cash farm income is derived from sales of crops. About three-fourths of the tobacco produced in the United States is grown in the Region. The Region includes the States of Delaware, Kentucky, Maryland, North Carolina, Tennessee, Virginia, and West Virginia.

Much of the land is hilly or rolling, and because of relatively heavy rainfall is subject to serious erosion. There are many streams whose muddied waters are a frequent reminder of the need for stopping this waste of soil. The winters are such that alternate freezing and thawing add to the erosion problem and cause an urgent need for winter cover crops.

There are few big towns, yet the Region is densely populated. On the average, the farm family has only about 30 acres of cropland. The average acreage of tobacco—the principal cash crop—is only 1 to 4 acres per farm, yet this acreage is adequate to meet market demand.

I. PARTICIPATION AND PAYMENTS UNDER 1938 PROGRAM

The number of farms participating in the A. A. A. farm program in the East Central Region has increased about 65 percent since 1936. In 1938, there were 633,000 farms in the program, and 965,000 persons (including share tenants and sharecroppers) received payments for compliance with the program's provisions. In 1936, about 390,000 farms were in the program, and in 1937 about 414,000.

Program compliance in 1938 entitled the participating farmers to a total of approximately $43,000,000 in conservation payments. In addition to conservation payments, cotton producers of the Region received $11,200,000 as cotton price-adjustment payments, which were made in 1938 on the 1937 cotton crop and which were conditioned on compliance with the cotton acreage allotments of 1938.

For 1938 a total of 113,000 cotton loans, 1,170 wheat loans, and 76 corn loans was made in the Region.

Farmers participating in the program in 1938 operated about 82 percent of 40 million acres of cropland in the Region. The total acre-

age of cropland in each State and the percent of this total acreage covered by the 1938 program are given in the following tabulation:

State	Cropland	
	Total acreage	Percent on farms in program
Delaware	581, 000	83. 2
Maryland	2, 507, 000	68. 2
Virginia	5, 865, 000	72. 3
West Virginia	1, 952, 000	68. 8
North Carolina	8, 089, 000	82. 7
Kentucky	11, 348, 000	87. 6
Tennessee	9, 924, 000	85. 9
East Central Region	40, 266, 000	81. 9

II. ADJUSTMENT IN CASH CROP ACREAGE

A high proportion of East Central Region farmers adjusted their acreages of cash crops in 1938. Between 85 and 95 percent of the acreage devoted to cotton, tobacco, and peanuts, and to "commercial" wheat, potatoes, and corn, was on farms that took part in the 1938 program. These adjustments made it possible to keep supplies more nearly in balance with market needs. With the decline of export markets, such adjustments were especially needed in keeping the cotton surplus from increasing and in preventing the building up of large surpluses of tobacco. Adjustments in the acreages of soil-depleting crops help by:

1. Tending to balance production with market requirements and hence to improve cash income.
2. Enabling many farmers to devote surplus-producing acres to the production of food and feed which is needed for home consumption on the farm.
3. Making it possible for farmers to improve land which has been overcropped.

III. SOIL-BUILDING ACCOMPLISHMENTS [3]

In 1938 farmers taking part in the program earned 45 percent of the total payment for carrying out soil-building practices. Under the 1937 program, only 30 percent of the payments to cooperating farmers were for carrying out soil-building practices; and 20 percent were for practices in 1936.

Payments in connection with soil-building practices, which are in addition to conservation payments for planting within soil-depleting acreage allotments, are made to cooperating farmers to help them pay the cost of approved practices which build up and improve the soil.

The soil-building practices in the 1938 program included establishment of permanent pasture, seeding specified legumes and grasses, turning under green-manure crops, application of limestone, application of superphosphate to permanent pastures or in connection with soil-conservation crops, terracing, and planting forest trees.

[3] Statistics quoted in this chapter are more recent and may vary slightly from those listed under Appendix B.

Among the most significant increases in soil-building practices under the program have been those in the use of limestone and phosphate. Before 1930 farmers in the seven East Central States used not more than a million tons of limestone per year. This dropped to less than one-half million tons a year in 1932 and 1933. In 1936, with the help of the Agricultural Conservation Program, over 1,000,000 tons of limestone were used; in 1937 the amount increased to 1,500,000 tons; and in 1938 it was 2,000,000 tons.

The increased use of phosphate under the A. A. A. program has been even more striking: In 1936, about 47,000 tons were applied; in 1937, applications totaled 127,000 tons; and in 1938, the figure was 234,000 tons. Slightly more than half of the 1938 quantity was furnished as grants-of-aid. The increase since the first year of the Agricultural Conservation Program has been approximately 400 percent.

Prior to the inauguration of the A. A. A. program, farmers in the Region for a number of years had used fertilizer to grow cash crops, but before 1936 they had used almost none to grow soil-conserving crops. All indications are that the payments under the A. A. A. program are largely responsible for the increased use of both lime and phosphate. The influence of these materials can be seen on the winter cover crops which farmers are using to protect and improve the soil. Their influence also can be seen in the increased acreage of legumes and grasses that add fertility and keep the soil from washing away.

It is estimated that the acreage of cropland which was protected by winter cover crops in 1938 was about 25 percent greater than the acreage which had such protection in 1936.

Seedings of legumes and grasses under the program have increased 50 percent since 1936. The use of green-manure crops and designated residue crops increased 175 percent from 1936 to 1938 and the planting of forest trees also increased 175 percent during this period. During the last 3 years, a total of 17,000 miles of terraces was built under the program in the Region, about one-third of which were built in 1938.

A summary of the principal soil-building practices carried out under the Agricultural Conservation Program in the Region during 1936, 1937, and 1938 is shown in the following tabulation:

Program year	Seeding legumes and grasses	Green-manure crops	Forest practices		Limestone (equivalent)	Superphosphate (in terms of 16-percent material)	Terracing
			Planting trees	Improving stands			
	Acres	*Acres*	*Acres*	*Acres*	*Tons*	*Tons*	*1,000 ft.*
1936	4, 884, 000	989, 000	1, 900	------	1, 191, 000	46, 800	35, 226
1937	5, 452, 000	2, 011, 000	3, 200	3, 700	1, 577, 000	127, 400	24, 043
1938	7, 489, 000	2, 736, 000	5, 200	5, 800	2, 014, 000	234, 300	31, 806

GRANTS-OF-AID

In 1937 the grant-of-aid provisions of the Agricultural Adjustment Act were first put into operation with the furnishing of 25,000 tons

of triple superphosphate to farmers in the East Central Region. In 1938 the Agricultural Adjustment Administration furnished the farmers 57,000 tons of triple superphosphate. This was an increase of 125 percent in 1938 over 1937.

In addition to the phosphate furnished in 1938, the farmers in nine counties of the East Central Region received more than 21,000 tons of liming materials as grants-of-aid. Also, 270,000 pounds of winter legume seed were furnished farmers in four North Carolina counties—Bertie, Duplin, Pender, and Hertford. As an example of the response of farmers to the furnishing of seed by the A. A. A., the acreage of vetch and Austrian winter peas in the four North Carolina counties increased from 690 acres in 1936 and 1,860 acres in 1937 to 9,280 acres seeded in 1938.

The furnishing of these materials direct to farmers as grants-of-aid, in lieu of equivalent conservation payments, was undertaken not for the purpose of creating a new scheme of distribution, but solely for the purpose of bringing about more soil-building practices. Figures indicate that materials furnished by the Government have been additions to, rather than substitutions for, materials purchased by farmers through regular commercial channels. These materials as grants-of-aid have proved most helpful to farmers who have not been able to obtain credit readily.

The program seems particularly well suited to the East Central Region, and farmers have made rapid strides forward in conserving and improving the soil since the program has been in operation.

IV. MARKETING QUOTAS IN EFFECT

As provided under the Agricultural Adjustment Act of 1938, and as determined by referendums among farmers, marketing quotas were in effect for the 1938–39 marketing year for flue-cured, Burley, fire-cured and dark air-cured tobacco, and for cotton. As a result of the vote in referendums held in the fall of 1938, cotton quotas were continued in effect for the 1939–40 marketing year, but tobacco marketing quotas were suspended for that year.

CHAPTER 7

THE PROGRAM FOR TOBACCO

Tobacco produced in the United States and Puerto Rico has been grouped into five major kinds for administrative purposes under the Agricultural Adjustment Act of 1938. The major kinds are flue-cured, Burley, fire-cured and dark air-cured, cigar, and Maryland tobacco.

More than 750,000 farm families in 26 States and Puerto Rico are engaged in the commercial production of these kinds of tobacco.

Following the enactment of the Agricultural Adjustment Act of 1938, which provided marketing quotas for the regulation of tobacco marketings, a Tobacco Section was set up in the Agricultural Adjustment Administration to handle the over-all tobacco programs. The chief functions of this section are to assist the regional divisions in working out uniform methods for determining tobacco farm allotments and quotas, to determine national and State tobacco allotments and quotas, and to handle the marketing and enforcement phases of administering tobacco quotas when they are in effect.

The Agricultural Adjustment Act of 1938 as originally approved provided for the establishment of a farm marketing quota in pounds for each farm. However, an amendment approved in August 1939 provides for the establishment of an acreage allotment for each farm and for a marketing quota equal to the actual production on that acreage allotment. While the acreage allotments established for farms are used both under the agricultural conservation program and under the marketing quota program, the two programs are separate in that farmers may or may not plant within their acreage allotments for the purpose of earning payments under the agricultural conservation program, while under the marketing quota program any tobacco marketed from a farm in excess of the farm quota is subject to the penalty provided in the act. The agricultural conservation program is in effect each year but the marketing quota program is in effect only under certain supply conditions and when approved by farmers in a referendum.

I. TOBACCO-QUOTA PROVISIONS OF THE ACT

The purpose of the tobacco marketing quotas is to provide a means whereby farmers can effectively adjust marketings of tobacco in line with demand so as to obtain fair prices for their tobacco.

Under the tobacco marketing quota provisions of the act of 1938, the Secretary is required to proclaim a quota for any kind of tobacco not later than December 1 if he finds that the total supply is in excess of the level defined in the act. Within 30 days after proclaiming the quota he is required to hold a referendum of growers of that

kind of tobacco, and if more than one-third of the farmers voting in the referendum oppose the quota, it is not in effect thereafter. If the Secretary finds that a larger amount of tobacco is needed to meet trade demands he may increase the national quota not later than December 31 by not more than 10 percent.

A quota proclaimed not later than November 30 of any year is applicable for the marketing year beginning July 1 of the next year in the case of flue-cured tobacco, and October 1 of the next year in the case of other kinds of tobacco. A quota proclaimed for one kind of tobacco is applicable only to that kind of tobacco. Thus, each of the several different kinds of tobacco, in effect, is treated as a separate commodity.

Marketing quotas can be proclaimed for any kind of tobacco only when the total supply is in excess of a "reserve supply level." This reserve supply level is 105 percent of a "normal supply," consisting of 275 percent of a normal year's domestic consumption plus 165 percent of a normal year's exports. The reserve supply level is such that it provides supplies adequate to meet trade needs.

The national marketing quota for any kind of tobacco is distributed among States on the basis of production during the preceding 5-year period with adjustments for trends, for abnormal conditions, and for small farms. The resulting State poundage quota for each State is then converted to a State acreage allotment by dividing the poundage-quota by a State yield-per-acre determined on the basis of the average yields in the State during the preceding 5 years, adjusted for abnormal conditions.

The State acreage allotment for each State is distributed among farms by local committees on the basis of the past tobacco acreage (harvested and diverted) adjusted for abnormal conditions; crop-rotation practices; the soil and other physical factors affecting the production of tobacco; and land, labor, and equipment available for the production of tobacco. Provision is made for increasing allotments on separately operated farms having small allotments up to the smaller of (a) 120 percent of such allotments or (b) that acreage which, with the normal yield for the farm, would produce 3,200 pounds in the case of flue-cured tobacco and 2,400 pounds in the case of other kinds of tobacco. Not over 5 percent of the national quota for any year may be reserved for making allotments to new tobacco farms, on which tobacco is grown for the first time in 5 years.

The marketing quota for each individual farm is the actual production on the acreage allotment established for the farm.

A penalty of 10 cents per pound in the case of flue-cured, Burley, and Maryland tobacco, and 5 cents per pound in the case of all other kinds of tobacco is imposed upon all tobacco marketed in excess of the marketing quota for the farm. This penalty is required to be paid by the warehouseman if the tobacco is sold through an auction warehouse and by the tobacco dealer if the tobacco is purchased by a dealer outside an auction warehouse.

In connection with the foregoing outline of the terms of the tobacco quota provisions, it may be noted that amendments to the law, passed in August 1939, had the effect of changing the quotas from a fixed number of pounds for each farm to the actual production on the acreage allotment established for the farm.

II. QUOTAS FOR 1938 AND 1939

Marketing quotas were proclaimed and voted upon for the 1938 crops (1938–39 marketing year) of flue-cured, Burley, and dark tobacco. Quotas were announced and voted upon for the 1939 crops (1939–40 marketing year) of the same kinds of tobacco. The vote on these quotas by States is shown in the following tabulation:

Vote on tobacco quotas for 1938 and 1939

FLUE-CURED TOBACCO

State	1938				1939			
	Number of votes cast			Percentage in favor	Number of votes cast			Percentage in favor
	Yes	No	Total		Yes	No	Total	
Alabama	32	0	32	100.0	112	8	120	93.3
Florida	1,969	1,511	3,480	56.6	2,589	1,564	4,153	62.3
Georgia	16,083	9,854	25,937	62.0	15,506	9,489	24,995	62.0
North Carolina	151,503	17,340	168,843	89.7	88,222	65,853	154,075	57.3
South Carolina	25,191	2,905	28,096	89.7	15,759	10,585	26,344	59.8
Virginia	25,064	3,643	28,707	87.3	10,272	13,434	23,706	43.3
United States, total	219,842	35,253	255,095	86.2	132,460	100,933	233,393	56.8

BURLEY TOBACCO

Alabama	17	0	17	100.0	44	1	45	97.8
Arkansas	8	0	8	100.0	14	4	18	77.8
Georgia	41	2	43	95.3	46	31	77	59.7
Illinois	13	2	15	86.7	8	10	18	44.4
Indiana	3,684	2,145	5,829	63.2	2,537	4,168	6,705	37.8
Kansas	21	13	34	61.8	25	51	76	32.9
Kentucky	104,890	9,754	114,644	91.5	92,456	33,817	126,273	73.2
Missouri	585	376	961	60.9	370	975	1,345	27.5
North Carolina	5,262	1,901	7,163	73.5	2,747	5,923	8,670	31.7
Ohio	3,473	1,946	5,419	64.1	2,133	4,552	6,685	31.9
Oklahoma					1	0	1	100.0
South Carolina	11	0	11	100.0	29	21	50	58.0
Tennessee	29,936	4,656	34,592	86.5	24,588	29,851	54,439	45.2
Virginia	5,175	1,686	6,861	75.4	3,478	7,315	10,793	32.2
West Virginia	1,092	389	1,481	73.7	647	1,497	2,144	30.2
United States, total	154,208	22,870	177,078	87.1	129,123	88,216	217,339	59.4

FIRE-CURED AND DARK AIR-CURED TOBACCO

Indiana	140	123	263	53.2	63	159	222	28.4
Kentucky	22,325	4,743	27,068	82.5	15,623	8,515	24,138	64.7
Tennessee	11,293	1,638	12,931	87.3	7,363	5,030	12,393	59.4
Virginia	5,570	2,956	8,526	65.3	3,370	3,613	6,983	48.3
United States, total	39,328	9,460	48,788	80.6	26,419	17,317	43,736	60.4

In the flue-cured referendum on quotas, it is estimated that approximately 300,000 farmers were eligible to vote. Of this number 255,095 voted on quotas for 1938 and 233,393 on quotas for 1939. Out of an estimated total of 250,000 eligible Burley farmers 177,078 voted on quotas for 1938, and 217,339 on quotas for 1939. Of the estimated 75,000 eligible dark-tobacco farmers, 48,788 voted on quotas for 1938, while 43,736 voted on quotas for 1939.

Quotas for 1938 crops of flue-cured, Burley, and fire-cured and dark air-cured tobacco were approved by majorities of 86.2 percent, 87.1 percent and 80.6 percent, respectively. Quotas for the 1939

crops of flue-cured, Burley, and fire-cured and dark air-cured tobacco received majorities of 56.8, 59.4, and 60.4 percent, respectively, and thus were not in effect because they were not approved by the required two-thirds majority.

The national and State quotas for 1938 are shown in the following tabulation:

Apportionment of 1938 national tobacco quota among States, including the amounts allotted to new farms

State	Flue-cured	Burley	Fire-cured and dark air-cured
	Pounds	*Pounds*	*Pounds*
Alabama	420, 000	113, 000	
Arkansas		26, 000	
Florida	11, 007, 000		
Georgia	74, 502, 000	36, 000	
Illinois		13, 000	
Indiana		9, 034, 000	489, 000
Kansas		339, 000	
Kentucky		240, 688, 000	73, 858, 000
Missouri		5, 311, 000	
North Carolina	487, 834, 000	8, 257, 000	
Ohio		11, 714, 000	
Oklahoma		5, 000	
South Carolina	84, 302, 000	13, 000	
Tennessee		58, 277, 000	47, 957, 000
Virginia	68, 864, 000	12, 273, 000	22, 269, 000
West Virginia		2, 868, 000	
New farms	21, 150, 000	7, 875, 000	3, 262, 000
Total, United States	748, 079, 000	356, 842, 000	147, 835, 000

III. PENALTIES COLLECTED

The estimated total penalties collected on sales of tobacco in excess of farm marketing quotas during the 1938–39 marketing year are: Flue-cured tobacco, $775,967.02; Burley tobacco, $134,113.29; and fire-cured and dark air-cured tobacco, $1,894.43; making a total of $911,974.74.

IV. ADMINISTRATIVE AND LEGAL ASPECTS

The agricultural adjustment programs from 1934 to 1938 resulted in a better supply situation for tobacco and more favorable prices for tobacco growers. It is probable that these favorable prices were the principal factor in the unfavorable vote by growers upon marketing quotas for 1939. Unquestionably, they caused farmers to become more impatient with allotments and quotas which would prevent the planting of as much tobacco as they wanted to plant in view of the favorable prices. However, the unfavorable vote reflected to some extent irritation on the part of growers arising out of difficulties encountered in the administration of the 1938 quota program. The difficulties resulted largely from lack of time in which to get the program in operation.

The Agricultural Adjustment Act of 1938 was approved on February 16, 1938. A referendum on quotas was held on March 12. There was not enough time to collect information and determine marketing quotas in pounds prior to the planting of tobacco by growers. Therefore, only the acreage allotments were determined and issued prior to the tobacco planting season from March to June of 1938. The quotas in pounds were determined later in keeping with the standards fixed in the act, but many growers, who had planted within the acreage allotments for their farms, were dissatisfied when they had more tobacco to sell than the amount of their quotas. Administration of the quotas also was made somewhat more difficult by the filing of suits to enjoin the collection of penalties.

Several suits were filed by growers in the State courts of Florida, Georgia, South Carolina, and North Carolina, under which the auction warehousemen were enjoined from paying penalties to the Secretary of Agriculture as provided in the act and were required to pay the penalties into the courts. These suits were based on the ground that the act was unconstitutional. The United States became a party to the first of these suits which was the *Mulford case.*

In the case of *Mulford* v. *Smith*, tobacco growers in South Georgia and North Florida sought through an injunction to restrain warehousemen from deducting the penalty from the price paid the grower. In the litigation that followed, the case was finally taken to the Supreme Court of the United States and the marketing quota provisions of the act were upheld by a 6 to 2 vote.

In declaring the marketing quota provisions of the act valid, the Court affirmed a decision of the District Court of the United States for the Middle District of Georgia (Valdosta division).

The points upon which the constitutionality of the act was attacked and the views expressed upon these points were as follows:

1. That the act constitutes a regulation of production and not regulation of interstate and foreign commerce of tobacco.

   The Court held that the act operates not on farm production, but upon marketing.

2. That the standard for allotting farm quotas is so uncertain, vague, and indefinite, that it amounts to a delegation of legislative power to an executive officer and thus violates the constitutional requirement that laws shall be enacted by the Congress.

   Responding to this second contention, the Court held "that definite standards are laid down for the government of the Secretary, first in fixing the quota and second in its allotment amongst States and farms."

3. That the act as applied to the 1938 crop deprives farmers of their property without due process of law.

   In replying to this third contention the Court said "it is argued that the statute operated retroactively and therefore amounted to a taking of appellant's property without due process. The argument overlooks the circumstances that the

statute operates not on farm production as the appellants insist, but upon the marketing of their tobacco in interstate commerce."

It is significant to point out that while the old Agricultural Adjustment Act of 1933 was declared unconstitutional mainly because it attempted to regulate the production of agricultural commodities, the decision in the case of *Mulford* v. *Smith* upheld the marketing quota provisions of the Agricultural Adjustment Act of 1938 as a valid regulation of marketings.

After the decision of the Court in the *Mulford case*, growers and officials of the Department, working with interested Congressmen and Senators, developed amendments designed to strengthen and make the act more workable and to overcome the principal administrative difficulties encountered in connection with the 1938 program.

The effect of these amendments is as follows:

Elimination of the requirement for a second referendum during any single marketing year for Burley and fire-cured and dark air-cured tobacco.

Provision is made for proclamation of a marketing quota at any time between the beginning of the marketing year and December 1 for each kind of tobacco, rather than between November 15 and December 1. The amendment also provides that the Secretary may increase the national marketing quota by not more than 10 percent, at any time between the date of the proclamation and December 31, provided the additional quantity of tobacco is needed to meet market demands.

Provision is made for converting the State marketing quota (as determined in pounds) into State acreage allotments by dividing into the quota for any State a yield per acre determined on the basis of the average yield during the past 5 years, adjusted for abnormal conditions. The State acreage allotment is then divided among farms. The farm marketing quota is the actual production on this acreage allotment. The acreage allotments are determined for all farms on the same basis, but for an independently operated small farm on which the normal yield of the acreage allotment is less than 3,200 pounds in the case of flue-cured tobacco and less than 2,400 pounds in the case of other kinds of tobacco, the allotment is required to be increased up to the smaller of 120 percent thereof or to that acreage which with the normal yield for the farm would produce 3,200 pounds in the case of flue-cured tobacco and 2,400 pounds in the case of other kinds of tobacco. This amendment removes the difficulty caused by inability of farmers to produce a quantity of tobacco equal to any fixed number of pounds, and instead bases the quotas on xed acreage allotments from which farmers can market their actual production. Provision is made for a flat penalty of 10 cents per pound on flue-cured, Burley, and Maryland tobacco, and 5 cents per pound on excess marketings of all other kinds.

CHAPTER 8

THE PROGRAM IN THE NORTHEAST REGION

Farmers of the Northeast Region are confronted with problems that differ essentially from those existing in other parts of the country. The States in this Region are Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, Connecticut, New York, New Jersey, and Pennsylvania.

Naturally and geographically adapted to industry, trade, and shipping, there is a heavy concentration of population in cities and towns.

Because of these facts the Northeast depends upon farmers in other Regions. A large part of its food and fiber for home use, or manufacture, or trading, must be produced elsewhere. And it must sell a large share of its products to farmers, or residents of farm States, who live to the south and west.

I. THE FARM SITUATION IN THE NORTHEAST

In this Region there is little or no need for downward adjustment of crop acreage except to stabilize production at normal levels. That explains why the acreage allotment part of the agricultural conservation program is so little used in the Northeast as, for all practical purposes, soil-building and soil-conserving practices suffice. For example: In 1937 about 90 percent of all A. A. A. payments earned in the Region were for these soil-improving practices.

The Northeast is not predominantly an agricultural area. Here but 1 person in 16 lives on a farm, in contrast with States like Texas where 2 persons out of every 5 belong to a farm family. In Rhode Island only 1 person out of 66 lives on a farm.

The greater portion of merchants' sales therefore must depend upon the purchasing power of factory workers. And Northeast factory pay rolls, in turn, depend to a greater extent upon the farm buying power of the country as a whole than upon the farm buying power of their own region.

AGRICULTURAL PRODUCTION HIGH

However, Northeastern agriculture is important in itself. While only about 7 percent of the Nation's farm people live in the Northeast Region, it produces from 10 to 12 percent of the value of farm products sold in the entire country.

With so much of its farm land located near large cities, the Northeast Region enjoys marketing advantages over other regions of the country. That is one reason why its agriculture is confined so largely to the production of perishables such as milk, poultry and eggs, fruits, and vegetables. These find a ready market in the cities.

Exceptions, of course, exist. Pennsylvania and western New York raise wheat and corn, and there is a beef-feeding district in the former State. Aroostook-Maine, Long Island, and New Jersey potatoes and Connecticut and Pennsylvania cigar tobacco are other exceptions. Dairy products, particularly fluid milk, are the most typical and widely produced agricultural commodities of the Northeast.

Wide fluctuations of production in other areas affect local markets, especially those for milk. When farmers, even in distant States, find that they cannot make a living in growing the crops that they are used to and prefer, they are most apt to shift into dairying, which brings them into competition with the established dairy farmers of the Northeast.

Most Northeast dairymen depend upon the sale of fluid milk in nearby towns and cities, which means that the price of milk is the largest single factor that determines their profit or loss. Milk prices depend in part on local market conditions. But they also depend upon the amount of cream shipped in from other regions and upon the price of butter. This competition in Northeastern markets depends upon whether farmers in other areas can make a decent living from hogs and beef cattle, wheat and cotton, or other products. Thus fluctuations in the production of these basic staple commodities create some of the most serious problems of the Northeast dairymen.

The need for soil-conservation has long been accepted in the Northeast. Well-kept farms are the rule. The Northeasterner thinks of his farm first as a home. It is a place for the family to settle down and live. That explains why one sees so many well-cared-for houses and barns. They are symbolic of the permanency so characteristic of the Region.

The Agricultural Adjustment Act of 1938, which became law February 16, 1938, made few changes in the soil-conservation part of the program as applied in the Northeast. Throughout most of the Region, there already was a healthy balance between the acreage of soil-depleting and soil-conserving crops, which meant that there was not as much need for acreage reduction there as in other sections of the country.

While in other parts of the country soil conservation best can be served by shifting some acreage from depleting to conserving crops, the desirable conservation methods in much of the Northeast area consist of such practices as improving existing hay land, pasture, and woodland; growing green-manure and cover crops; mulching vegetable land and orchards; reforestation; and other erosion-control practices. However, on certain farms, shifts from soil-depleting to soil-conserving crops are needed, to promote better balance of production and conservation.

Under the 1938 program, county A. A. A. committees assigned crop-acreage allotments and soil-building goals to each participating farm. The acreage allotment was subdivided into three groups—potato and tobacco acreage allotments, and a total acreage allotment which included all depleting crop-acreages.

PURCHASING POWER HIGHER

The Northeastern farmer's income during the period covered by this report would buy more goods than it would 10 years ago.

Although cash farm income from the sale of crops, livestock, and livestock products in the Northeastern States was but 85 or 90 percent of predepression levels, its real value in terms of buying power was higher than in the pre-1929 era because of the decreases that had occurred in the prices of things farmers buy. In 1937 the money income of Northeastern farmers would buy 10 percent more than in the earlier period. The comparable figure for 1938 was 8 percent.

The cash income of farmers in the nine Northeastern States averaged a little over a billion dollars a year through the years that are apt to be thought of as good years, including and preceding 1929. By 1932 it had sunk to under $600,000,000, and in 1933 had increased to $650,000,000. In both years it was about 60 percent of the predepression amount. There was a steady recovery each year after that time, the figure reaching $921,000,000 in 1937 with a drop to a little over $850,000,000 in 1938.

The problem of sustaining farmers' incomes under the trying conditions of the present transition period is extremely difficult, but the degree of success that has been obtained up to the present, while not adequate to meet the need, at least gives considerable assurance that the agencies at work are proving effective.

II. PARTICIPATION IN PROGRAM [4]

Gross payments earned by Northeast farmers for participation in the 1938 program reached nearly $12,000,000 compared with $10,324,000 for 1937. The latest revised gross figure for 1938 is $11,924,866, compared with $10,323,796 in 1937. The gross figure includes expenses of county agricultural conservation associations. Deductions for that purpose amount to about 10 percent of the total payments. Net payments to farmers for performance totaled $11,036,111, and deductions in connection with county association expenses $922,212.

MANY ACRES IMPROVED

Farmers cooperating in the 1938 program earned payments for establishing new seedings of soil-conserving grasses and legumes on approximately 993,091 acres in the Northeast, as compared with 1,205,043 acres in 1937, which was 34 percent more than was planted in 1936.

Other soil-building practices carried out in 1938 included the growing of green-manure crops which provided cover and then were turned under to enrich the soil. This practice was carried out on 424,987 acres, as compared with 360,780 acres in 1937. Mulch totaling 188,138 tons was applied to orchard and vegetable land in 1938, as compared with 135,607 tons applied in 1937.

During 1938 significant advances also were made in forestry practices even though the acreage involved remained comparatively small. In addition, farm woodlots were improved under the special forestry practices added for rehabilitation of woodlands damaged by the hurricane of September 1938. Other practices, which were of local rather than Regional importance, included strip cropping, contour cultivation, and removal of unproductive orchards and vineyards.

[4] Statistics quoted in this chapter are more recent and may vary slightly from those listed under Appendix B.

USE OF GRANTS-OF-AID

Under the 1938 program most of the Northeast cooperation was confined to carrying out soil-building practices both with and without use of the grants-of-aid provisions for the furnishing of lime and superphosphate in lieu of the cash conservation payment. Tobacco and potato acreages were adjusted under the allotment provisions of the program. General soil-depleting crops also were stabilized with allotments. Furnishing of soil-building materials in place of cash payment was tried out experimentally in five of the nine States of the Region and, due to its success, was extended under the 1939 program to all States except New Jersey.

The indicated increased participation in the 1939 program is largely attributed to the wider use of the grants-of-aid provision for furnishing lime and superphosphate. Many farmers wanted to take part in the soil-building program but were unable to finance the purchase of materials. By supplying lime and superphosphate in place of cash payments it became possible for farmers who could not otherwise obtain materials to get them on the credit of their conservation payment when earned.

The use of limestone to restore soil fertility has been the leading soil-building practice in the Northeast since 1937. Some counties and even entire States report farmers are using 10 times as much lime now as they did before the conservation program was inaugurated in 1936. Lime and phosphorus are required by Northeast soil in order to obtain good stands of legumes and to keep pasture sod in condition. Clovers, alfalfa, and better pastures not only help maintain fertility but also reduce costs of feeding livestock, particularly dairy cows. Use of legume hay in connection with restored pastures with good stands of clovers makes it possible to cut cash outlay for feed for dairy stock from a third to one-half, according to pasture specialists.

MILLION TONS OF LIMESTONE USED

More than a million tons of limestone were applied as part of farmers' participation in the 1938 program. That was over three times the amount of limestone applied for which payments were made in 1936. Orders placed during the first half of 1939 indicated that a new all-time high record will be established for the use of lime under the 1939 program.

Under the grants-of-aid provision the use of superphosphate also has increased. Applications of superphosphate for which payments were earned in 1937 totaled more than 233,000 tons, figured on the basis of 16 percent concentration. This was well over twice the amount on which payment was made in 1936.

An intensive campaign to improve pastures through increased use of lime and superphosphate under the grants-of-aid provision of the program got under way in Pennsylvania during the summer of 1939. The goal sought was to improve three times the acreage of pasture that was treated in 1938. The aim was to get lime and phosphate to 30,000 farmers, which would be more than three times the 8,000 farm pastures upon which fertilizer was applied in 1938. The grants-of-aid provision for materials was limited to use for pasture improvement in Pennsylvania because constant grazing had reduced

the fertility of pasture land in that State, which is so dependent upon dairying.

Only 40,000 acres of the 3,200,000 acres of Pennsylvania pasture land have been improved with lime and phosphate. State authorities estimate that a yearly application of 328,000 tons of lime and 82,000 tons of superphosphate is needed. Yet farmers who participated in the 1937 program applied only 41,870 tons of lime and 6,361 tons of superphosphate to their pastures. In New England, farmers are still using only about 10 percent of the amount of lime needed to maintain the fertility of the soil.

GOOD FARMING PRACTICES INCREASE

In Vermont farmers used from 3,000 to 3,500 tons of lime and about the same amount of superphosphate each year prior to 1933. In 1938 they used 20,998 tons of lime and 26,451 tons of superphosphate. The annual need is estimated at about 283,000 tons of lime and 141,000 tons of superphosphate for cropland and pasture.

Maine farmers used from 3,000 to 9,000 tons of lime annually prior to 1935. In 1938 they spread 32,370 tons. The use of superphosphate has increased from practically none before the program to 9,198 tons in 1938. The use of potash has increased from practically none before 1936 to 680 tons in 1938. New seedings increased from 61,877 acres in 1936 to 97,398 acres in 1938, and the planting of green-manure crops from 15,000 acres to 19,000 acres in 1938.

New Hampshire farmers in 1936 used 1,104 tons of 16 percent superphosphate; in 1938 they used 5,421 tons. The use of potash increased from 127 tons in 1936 to 381 tons in 1938; lime from 5,321 tons to 12,967 tons; and orchard mulching material from 858 tons in 1937 to 2,219 tons in 1938. Acreage of woodland improved in 1937 was 2,028; in 1938 New Hampshire farmers improved 2,988 acres.

In 1936 New York farmers used 57,845 tons of superphosphate and 144,357 tons of lime; in 1938 they used 74,509 tons of superphosphate and 275,494 tons of lime. In 1936 they reforested 868 acres; in 1938 they reforested 2,827 acres.

Use of limestone in Connecticut has increased about 300 percent since the A. A. A. program started, according to estimates made in the State. It is expected that about 38,000 tons will be used in 1939.

III. PROGRAMS FOR SPECIAL CROPS

Under the 1937 program, in diversion areas, payments were made for diverting potato lands from the general soil-depleting base. In nondiversion areas special rates applied for green-manure crops grown on potato land.

Potatoes were first classified as an allotment crop in the 1938 program as a result of a Nation-wide referendum on the proposal in 1937. Commercial potato growers in the Northeast voted about 8 to 1 in favor of potato allotments. The national potato goal for 1938 was established at between 3,100,000 acres and 3,300,000 acres, which is the same goal range tentatively fixed for 1939. The goal represents the acreage believed to be sufficient to grow all the potatoes the country needs and which with normal yields would give the growers

a fair return for the potatoes marketed. In assigning the individual allotments, county committees make some allowance for conditions on particular farms. The allotments do not apply to farmers who do not grow potatoes on a commercial scale.

CIGAR TOBACCO GROWERS IN PROGRAM

The farm program provides two methods by which cigar tobacco growers can help maintain supply in balance with demand. First, the farm acreage allotments set up by the county committees provide, with normal yields, for production of a crop which will maintain the supply at a normal relationship with the amount used. In addition, if the total supply becomes excessive, that is, more than 5 percent above the normal level, producers may establish quotas to limit the quantity of tobacco marketed. There are other factors such as weather which will affect the supply, but general participation in the acreage-allotment part of the program is usually adequate to keep the supply in balance with demand, so that marketing quotas need not be invoked.

ACREAGE ALLOTMENTS

Potato and tobacco allotments are directly in the interest of many farmers in the Northeast. For most farmers in the Region, however, it was found that general crop acreage allotments were not so important as a means of encouraging acreage adjustment, so the general acreage allotment was dropped from the Northeast program for 1939. The entire Region was given a "C" area designation under which no payment was made for diverting general soil-depleting crops, and total soil-depleting acreage allotments were not established. This system better adapts the program to the agricultural economy of the Region. Corn and vegetable acreage limits, equal to the acreage usually grown, were established for 1939, in addition to the special acreage allotments for potatoes, tobacco, and wheat.

IV. DEVELOPMENTS UNDER 1939 PROGRAM

The 1939 program is much the same as that for 1938. Farmers who cooperate by carrying out on their farms those steps in good farming which are called soil-conserving or soil-building practices, and who help to prevent overproduction by stabilizing their acreages of commercial potatoes, wheat, tobacco, commercial vegetables, and corn for grain, are given financial assistance in meeting the expenses of their cooperation. The soil-building practices, in general, are similar to those included in the 1938 program.

The 1939 vegetable program is entirely different. In 1938 the Northeast was the only region which had a vegetable program. In 1939 commercial vegetables are included in the national program. This provision applies, however, only to farms in designated commercial vegetable areas. The acreage allotted to each farm is its usual acreage and does not represent a reduction. Allotments are made to each farm in the vegetable areas which normally grows 3 or more acres of vegetables for market.

The more important changes in the 1939 program from that of 1938 include the dropping of the so-called general and total soil-depleting crop allotments which have been features of previous programs, and placing emphasis on the stabilization of acreage of the major soil-depleting crops in the Region.

SPECIAL FARM FORESTRY PRACTICES

A special farm forestry practice for areas of New England and Long Island, N. Y., damaged by the hurricane of September 1938, was added to the 1939 conservation program for the Northeast. Payments for this practice were in addition to other forestry practices provided by the conservation program. Payment was at the rate of $4 per acre of farm woodland up to a maximum of 15 acres, or $60. These payments were earned by cleaning up damaged woodlands to permit new growth and reduce fire hazard.

The United States Forest Service estimated that 4 billion board feet of timber were blown down by the hurricane, which is eight times the average annual cut in New England. Nearly half of the farmland in the area damaged by the storm is in timber, which contributes substantially to the farm income. On the basis of available figures, there were approximately 6,500 farm wood lots on March 1 which had applied for this special practice. Of this number, approximately 5,000 farm wood lots with 55,000 acres of woodland entered for clean-up had been approved by county committees on that date.

LARGER PARTICIPATION INDICATED

Preliminary estimates of Northeast participation in the 1939 program indicated an all-time high for the Region. Increased participation is attributed to a greater understanding and appreciation by farmers of the need for soil conservation. Total Northeast participation in the 1939 program is expected to reach about 220,000 of the estimated 324,000 commercial farms in the Region, or over 70 percent. On the basis of sign-ups completed by mid-April 1939, every State reported an increase in participation.

WHEAT FARMERS USE CROP INSURANCE

Nearly 3,000 wheat growers in the three Northeastern States which grow wheat, Pennsylvania, New York, and New Jersey, had their 1939 crop protected from serious loss through insurance with the Federal Crop Insurance Corporation. Their policies insured a total production of 589,493 bushels of wheat on 38,941 acres. Wheat growers had a favorable winter generally throughout the Region. Although there was injury in some sections from such causes as hail, flood, winter-killing, and severe spring-heaving, there was no complete loss of crop reported by any farm.

CHAPTER 9

PROGRAM IN THE INSULAR REGION

The Insular Region, comprising Alaska, Hawaii, and Puerto Rico, includes a wide range of agricultural conditions and enterprises. The agricultural conservation program for the Region represents an adaptation of the national program to the adjustment and conservation problems of the Region.

The 1938 program included acreage allotments for tobacco in Puerto Rico, but more than two-thirds of the payments were made for carrying out soil-building practices. The principal practices included in the program were planting conserving crops, reseeding pasture and range land, planting and maintaining trees, and erosion-control practices such as terracing, ditching, and contour planting.

Approximately 68,000 farmers in the Region participated in the 1938 program, compared with 55,000 in 1937. The number participating in 1938 comprised nearly 95 percent of the total number of farmers in the Region, and their farms included approximately 1,000,000 acres of cropland and 1,000,000 acres of pasture and range land. Total payments for the Insular Region under the 1938 program are estimated at $1,560,000.

CHAPTER 10

ACTIVITIES OF THE CONSUMERS' COUNSEL DIVISION

The unmistakable growth of the consumer movement during 1938–39 was reflected in an increasing demand for service from the Consumers' Counsel Division. With greater insistence than ever before, both rural and urban families are asking: How can we raise our standard of living through the wise use of our individual and group buying power?

I. DEVELOPMENTS IN CONSUMER ACTIVITIES

In their search for information and counsel on budgetary problems, on intelligent selection of goods and services, on prices and costs of commodities, these consumers turn both to Government and business for help. The work of the Consumers' Counsel Division has been to provide, within its field, a part of the help that consumers are asking from Government. In the field of business, a significant development is the growing readiness to appraise policies in the light of consumer demands. This has been evidenced by the first Business-Consumer Relations Conference on advertising and selling, held by the National Association of Better Business Bureaus, published reports on the consumer movement by the American Retail Federation and a leading business magazine, and continued growth of the National Consumer-Retailer Council. Schools are also making adjustments in their curricula to include more consumer education. The Consumers' Counsel Division has been informed that 211 school systems have inaugurated courses dealing exclusively with consumer problems. This count is indicative of a trend, and is not complete.

CONSUMERS ASK MORE QUESTIONS

Embraced in the consumer movement are more than 5,000,000 men and women who are engaged in finding answers to such questions as these: What standards of quality exist now or can be developed to enable consumers to compare products and prices? How should products be used to insure the most efficient and economic service? How much of the price consumers pay goes to farmers and to workers? How much is due to special services offered consumers? How can an adequate supply of goods and services be assured at prices all consumers can afford?

Other large groups of consumers, predominantly in rural areas, are engaged in the cooperative purchase of farm and household necessities.

The amount of cooperative buying done by farm families in 1936–37 was $400,000,000; in 1937–38, $440,000,000; in 1938–39, $416,000,000. The drop in the dollar value of these purchases in the last year was due chiefly to lower prices rather than a reduced physical volume. The latest available figures on urban cooperative enterprise are for 1936 when sales totaled $70,000,000.

An increasing number of consumers are now concerning themselves with the administration of laws affecting the price and quality of goods marketed. Thus, they have appeared before the Food and Drug Administration to present the consumer interest in regulations controlling the use of coal-tar dyes in foods, drugs, and cosmetics, and in the establishment of standards of identity, fill, and quality for foods. Other consumers appeared, during the year, before the A. A. A. on questions involved in marketing agreements; before the Federal Trade Commission on trade-practice rules affecting fabric identification; before the Temporary National Economic Committee on difficulties confronting consumers in making their purchases.

In greater numbers than in any preceding year, consumers have requested of the Consumers' Counsel Division buying information on almost every kind of commodity, price-and-supply information, suggestions for study courses, guidance on problems arising from the operation of cooperatives, advice on the problems of conducting forums and discussion groups, advice on the organization of conferences, exhibit material, assistance in the preparation of material for presentation before hearings in Federal agencies, assistance in coordinating consumer activities, and finally, speakers for meetings. Such requests totalled over 35,000 during the year, almost three times the number received 2 years earlier.

During 1938–39 the Consumers' Counsel Division undertook to expand its services to meet the increased demands upon it while operating within the framework of its two major responsibilities: (1) The representation of consumer interests in the formulation and administration of the various phases of the farm program, and (2) the promotion of a more efficient utilization of farm products by compiling and publishing information enabling consumers (*a*) to understand farm problems which affect them, and (*b*) to receive help in the intelligent selection and utilization of farm products.

Economists from the Division during 1938 attended conferences and hearings on, and undertook studies of the effects of, agricultural conservation programs, marketing agreements, and proposals for the diversion of surplus farm products. After attempting to determine the effect of these proposals upon prices and supplies, the Consumers' Counsel Division then recommended the acceptance, the modification, or the rejection of the various programs.

Considerable activity throughout the year was devoted to furnishing information to consumer groups on the milk marketing agreement and order program. This work involved research into the history and operations of sundry milk markets, analysis of various legislative measures, and the study of marketing devices affecting the consumption of milk. The Division explored new possibilities for expanding the consumption of milk by low-income and relief groups, and cooperated with the Dairy Section in developing specific

proposals directed toward accomplishing this end. Educational work was also done to develop a better understanding by consumers of the highly technical and complex problems surrounding the marketing of milk.

A special responsibility rests upon the Division in connection with the consumer-protection provisions of the Sugar Act of 1937. In administering this law the Secretary of Agriculture is required to take account of sugar consumption, prospective changes in population, and consumer incomes. The Division assisted the Sugar Division in preparing the technical information necessary for determination of sugar quotas.

Complementing the work on specific programs, the research section of the Division has conducted continuous studies of the retail prices of farm products, spreads between retail and farm prices, processors' margins, distribution costs, and of the financial statements of processors. As a basis for a study of possible increased markets for cotton goods, the Division cooperated with the Bureau of Home Economics in the analysis of expenditures for clothing by families at different income levels, of different compositions, and different occupational groups.

Assistance was also given by the Division through its information service to the development of the school-lunch program, and the Food Order Stamp Plan of the Federal Surplus Commodities Corporation.

In response to an appeal for help from the committee for the improvement of the Philadelphia (Pennsylvania) market, the Division has been counseling with growers, dealers, and consumers in that city as to the modernization of marketing facilities for perishable foods. Both the Bureau of Agricultural Economics and the State marketing agencies in Pennsylvania and New Jersey cooperated with the Division in this activity, which looks toward a reduction in costs to consumers and of losses to growers.

The Division has continued to participate in the work of the special committees within the Department insofar as they deal with problems affected with a consumer interest.

II. INFORMATION SERVICES

The Division publishes the Consumers' Guide; broadcasts over a Nation-wide network a weekly program on consumer problems; handles a large volume of correspondence; supplies speakers and exhibits for meetings, conferences, and conventions; publishes the Consumers Market Service; and performs other informational services for consumers.

Of all these activities the most important has been the publication of the Consumers' Guide, an illustrated bulletin with a circulation of 135,000 copies, which appears twice a month from October through May and once a month from June through September.

CONSUMERS' GUIDE

Subscribers to the Consumers' Guide include housewives, teachers, students, and representatives from almost every trade and profession.

Guide articles during the year have supplied consumers with information on the intelligent and economic selection and utilization of farm products, on the operations of the farm program, on activities of Government agencies in behalf of consumers, and on general aids in buying which would enable low-income families to spend their earnings more efficiently. During the year articles appeared on the range and wheat programs of the A. A. A., on the food order stamp plan, on the school-lunch program, on the utilization of cotton through the W. P. A. sewing programs, on consumer credit, and on the distribution and consumption of milk. Regular reports are carried on changes in prices and supplies of foods.

The fact that Consumers' Guide articles are reprinted widely in general magazines, and in farm, labor, and trade papers, is evidence of the need for the type of information made available in this publication.

Marking the fifth anniversary of the Consumers' Guide, a special issue was published which was given over entirely to a picture interpretation of income distribution in the United States. This was based on material collected by the National Resources Committee and published in more technical form in "Consumer Incomes in the United States."

Requests for information on consumer education and on possible courses for the study of consumer problems led the Division during the year to prepare a study plan based upon material published in the Consumers' Guide. To permit the wide use of the course by consumer groups, reprints of Consumers' Guide articles to which reference was made in the course are attached to the plan of study. More than 1,500 of the study courses were distributed during the year.

A Consumers' Guide article dealing with the farm program in relation to national welfare suggested to Consumers' Guide readers that any six people could form their own study club. In the brief time since the publication of this article, 500 requests for study material have been received.

OTHER PUBLICATIONS

During the year it was also necessary to print second editions of two Consumers' Counsel publications, the Consumers' Bookshelf and the Cooperative Bookshelf. These publications, which sell for 15 cents and 5 cents, respectively, are bibliographies of free or low-cost publications of interest to consumers.

RADIO

Once a week during the year, over a national network, the Consumers' Counsel Division, with the collaboration of the General Federation of Women's Clubs, has broadcast discussions of consumer problems.

As in the Consumers' Guide, this weekly radio program presents in easy informal style information on the farm program and the use of farm products, and news about the activities of Government agencies which are of concern to consumers.

CONSUMERS' MARKET SERVICE

Reaching more than 3,500 persons semimonthly, the Consumers' Market Service, a two-page mimeographed bulletin, fills a need for food price-and-supply information for persons untrained in the handling of technical market data who make bulk purchases for consumer groups and public institutions.

CONSUMER NOTES

At the request of editors of labor, consumer, and cooperative publications, the Consumers' Counsel Division inaugurated a clip-sheet service. Under the title, Consumer Notes, this service provides two pages of succinct paragraphs containing useful buying information for consumers. These notes are now printed as a regular feature of more than 100 daily, weekly, biweekly, and monthly papers.

EXHIBITS

Posters, charts, pictures, graphs, presenting dramatically the information assembled by the Consumers' Counsel Division, have been displayed during the year at the San Francisco Fair, the Seventh Annual Poultry Congress, at national conventions of consumer cooperative and labor organizations.

In addition, writers of textbooks on matters of consumer interest, writers of articles about consumers, and editors of trade papers have requested and received copies of photographs which have appeared in the Consumers' Guide during the year.

CORRESPONDENCE

Main stream of direct communication between consumers and the Consumers' Counsel Division is by mail. The number of letters requesting information from the Consumers' Counsel Division has risen from an annual total of 10,304 in 1936 to 35,393 in 1938–39. Requests for information come from trade associations, labor unions, and business concerns, as well as from homemakers, students, teachers, and marketing officials. Largest proportion of the mail, however, consists of requests from individuals with personal or family buying problems.

Under pressure of the growing number of inquiries the Consumers' Counsel Division has built up a Consumer Information File containing more than 10,000 newspaper and magazine clippings, and pamphlets, in addition to references to pages in standard treatises. These files now serve a useful purpose as a source of immediate information on a wide variety of consumer subjects.

III. CONSUMER STANDARDS PROJECT

Since July 1938, the Consumers' Counsel Division has undertaken the sponsorship of a W. P. A. Federal project, known as the Consumer Standards Project. This activity, which had previously been conducted as the Consumers' Project under the direction of the Department of Labor, provides employment for 150 clerical workers from relief rolls.

During the year the project was engaged on the following activities:

A survey of Federal, State, and municipal trade standards for consumer goods, with particular reference to economic aspects of grades, labels, and standards for consumer goods.

A survey of consumer goods standards in foreign countries, as established by government, standardization agencies, and trade bodies.

The organization and classification of the files of Consumers' Advisory Board of the National Recovery Administration and of the Consumers' Division of the National Emergency Council.

A study, undertaken with the cooperation of the National Consumer-Retailer Council, of the type of information desired by consumers, retailers, and manufacturers on the labels of 12 articles usually purchased by consumers.

A study of weights-and-measures laws and their administration throughout the country.

A study of the method of teaching and the material taught in consumer education courses throughout the country.

Compilation of a library and card index file on consumer information.

A survey of cooperative purchasing organizations and the framing of a model cooperative law.

A study of the relationship of meat grades to the palatability of the meat.

CHAPTER 11

FINANCIAL REPORT

Total certifications for payments and obligations under the 1938 Agricultural Conservation Program amounted to $499,999,278 through June 30, 1939.

Of this total, $461,549,278.39 represents payments disbursed or due to be disbursed to cooperators in the 1938 Agricultural Conservation Program, together with national and local administrative expense. Obligations of approximately $38,450,000 also were incurred in carrying out other activities authorized under the appropriation for the Agricultural Conservation Program. When final adjustments are made it is anticipated that expenditures will approximate the $500,000,000 appropriated for these purposes.

Other obligations incurred included the following: $4,000,000 for the establishment of regional laboratories and development of new uses and markets for agricultural commodities; $101,500 in connection with proceedings regarding freight-rate adjustments affecting agricultural products; $23,200,000 under Section 12 of the Soil Conservation and Domestic Allotment Act, as amended, to supplement Section 32 funds; $5,200,000 for advance payments on the 1939 program covering grants-of-aid in seed, lime, and fertilizer; $6,000,000 advances to county associations of farmers for carrying into effect the 1939 Agricultural Conservation Program, which is deductible from payments to be earned under that program.

These figures are not to be confused with the 1938 program figures shown in the "Statement of Expenditures—July 1, 1938 to June 30, 1939," issued by the A. A. A. Division of Fiscal Management, Control Accounts and Reports Section. The "Statement of Expenditures" shows actual disbursements by disbursing offices, while the amounts shown above represent obligations incurred under the 1938 Agricultural Conservation Program appropriation.

EXPENDITURES DURING FISCAL YEAR ENDING JUNE 30, 1939

The expenditures of the Agricultural Adjustment Administration during the fiscal year totaled $621,598,497.35. This does not include payments for purchase and diversion of agricultural commodities and payments under the Sugar Act of 1937.

The purposes for which these expenditures were made are shown in the following tabulations:

Agricultural conservation payments	$456,335,724.04
1937 cotton price-adjustment payments	121,663,661.65
Payments, Price Adjustment Act of 1938	22,826,045.62
Miscellaneous expenditures	1,141,242.78
Expenses for all programs administered by the A. A. A	19,631,823.26
Total	621,598,497.35

AGRICULTURAL CONSERVATION PAYMENTS

During the fiscal year ending June 30, 1939, conservation payments were made under the various conservation programs as follows:

1936 agricultural conservation program	$20,663.98
1937 agricultural conservation program	35,895,295.14
1938 agricultural conservation program	403,127,524.77
1939 agricultural conservation program	17,292,240.15
Total	456,335,724.04

THE 1937 COTTON PRICE ADJUSTMENT ACT

The act of August 25, 1937 (Public, No. 354), appropriated $130,000,000 of "Section 32" funds for price-adjustment payments to 1937 cotton producers to make up in part for the drop in the price of cotton and give them a better return for their crop. Payments were made on the 1937 crop only, up to 60 percent of the producer's 1937 base production or on actual production if less than 60 percent of 1937 base production. To obtain these payments, producers were required to furnish proof of compliance with the 1938 program. Such payments during the fiscal year ending June 30, 1939, totaled $121,663,661.65.

PRICE ADJUSTMENT ACT OF 1938

The Agricultural Adjustment Act of 1938 authorized "parity" payments to producers of cotton, wheat, corn, rice, and tobacco, if and when appropriations were made for such payments.

Under the Price Adjustment Act of 1938, $212,000,000 was appropriated for price-adjustment payments to be apportioned among the five commodities as follows: One-half of the sum on the basis of the amount by which each commodity fails to reach parity, and one-half on the same basis as that on which funds are apportioned for the same commodities under the 1939 Agricultural Conservation Program. In no case is the rate to exceed the difference between the average farm price of the commodity and 75 percent of the parity price for the period from the beginning of the marketing year to January 31, 1939.

Payments are to be made to producers who plant within their 1939 acreage allotments of the basic commodities. During the fiscal year ending June 30, 1939, these payments amounted to $22,826,045.62.

MISCELLANEOUS EXPENDITURES

Included in this item are payments and refunds made in connection with various programs, the principal item being payments for retirement of cotton pool participation trust certificates. The Department of Agriculture Appropriation Act for the fiscal year ending June 30, 1939, provided $1,800,000 for the retirement of these certificates.

PAYMENTS TO PRODUCERS, JULY 1, 1938, TO JUNE 30, 1939, INCLUSIVE, FOR COOPERATING IN THE 1936 PROGRAM

	Total	Conservation payments	County associations
Southern division:			
South Carolina	*$2,120.84*	*$2,120.84*	
Georgia	*2,714.02*	*2,714.02*	
Florida	*98.26*	*98.26*	
Alabama	*6,735.64*	*6,735.64*	
Mississippi	639.81	639.81	
Arkansas	8,452.49	8,452.49	
Louisiana	3,987.20	3,987.20	
Oklahoma	3,370.32	3,370.32	
Texas	46,507.76	46,507.76	
Total	51,288.82	51,288.82	
East Central division:			
Maryland	315.67	315.67	
Delaware	14.89	14.89	
Virginia	*101.77*	*101.77*	
West Virginia	123.47	123.47	
North Carolina	4,483.72	4,483.72	
Kentucky	1,124.29	1,124.29	
Tennessee	1,838.32	1,838.32	
Total	7,798.59	7,798.59	
Northeast division:			
Maine	52.26	52.26	
New York	241.21	241.21	
New Jersey	49.00	49.00	
Pennsylvania	114.98	114.98	
Total	457.45	457.45	
North Central division:			
Ohio	*317.76*	*249.84*	*$67.92*
Indiana	*786.65*	*786.65*	
Illinois	*776.26*	*773.71*	*2.55*
Michigan	*257.06*	*223.31*	*33.75*
Wisconsin	*5,508.52*	*5,508.52*	
Minnesota	788.66	779.66	9.00
Iowa	1,782.80	1,782.80	
Missouri	2,263.44	2,257.95	5.49
South Dakota	633.97	633.97	
Nebraska	3,303.02	3,303.02	
Total	1,125.64	1,215.37	*89.73*
Western division:			
North Dakota	*20,756.73*	*20,756.73*	
Kansas	3,025.76	3,013.76	12.00
Montana	*1,955.66*	*1,955.66*	
Idaho	1,915.31	1,915.31	
Wyoming	901.81	901.81	
Colorado	380.12	380.12	
New Mexico	3,402.46	3,428.63	*26.17*
Utah	*562.37*	*562.37*	
Washington	22.98	22.98	
Oregon	119.02	139.36	*20.34*
California	*897.11*	*897.11*	
Total	*14,404.41*	*14,369.90*	*34.51*
Insular division:			
Puerto Rico	1,247.10	1,247.10	
Undistributed	*26,849.21*	*26,849.21*	
GRAND TOTAL	20,663.98	20,788.22	*124.24*

NOTE.—Italicized figures represent credits.

PAYMENTS TO PRODUCERS, JULY 1, 1938, TO JUNE 30, 1939, INCLUSIVE, FOR COOPERATING IN THE 1937 PROGRAM

	Total	Conservation payments	Cotton price adjustment payments	County associations
Southern division:				
South Carolina	$8,461,889.92	$888,051.52	$7,573,838.40	
Georgia	14,611,815.53	4,124,097.70	10,487,717.83	
Florida	517,108.55	244,480.18	272,628.37	
Alabama	15,596,455.92	4,871,851.41	10,724,599.51	$5.00
Mississippi	14,443,327.71	1,019,417.13	13,424,384.13	*473.55*
Arkansas	12,702,902.49	974,697.67	11,727,993.82	211.00
Louisiana	7,900,412.36	1,862,967.37	6,037,444.99	
Oklahoma	9,867,979.95	1,427,544.33	8,440,435.62	
Texas	36,974,550.33	2,908,638.28	34,066,054.80	*142.75*
Total	121,076,442.76	18,321,745.59	102,755,097.47	*400.30*
East Central division:				
Maryland	153,731.86	153,731.86		
Delaware	*2,329.60*	3,675.98		*6,005.58*
Virginia	1,081,323.57	731,760.88	342,720.36	6,842.33
West Virginia	91,008.86	90,307.46		701.40
North Carolina	8,069,322.88	1,659,512.44	6,409,336.89	473.55
Kentucky	501,625.38	391,965.54	109,659.84	
Tennessee	5,273,805.36	1,005,332.04	4,265,865.07	2,608.25
Total	15,168,488.31	4,036,286.20	11,127,582.16	4,619.95
Northeast division:				
Maine	936.43	936.43		
New Hampshire	250.98	250.98		
Vermont	806.57	806.57		
Massachusetts	1,400.28	1,400.28		
Rhode Island	123.25	123.25		
Connecticut	2,168.96	2,168.96		
New York	12,072.17	12,072.17		
New Jersey	1,843.71	1,843.71		
Pennsylvania	6,869.51	6,869.51		
Total	26,471.86	26,471.86		
North Central division:				
Ohio	688,168.71	687,223.40		945.31
Indiana	541,487.60	541,487.60		
Illinois	385,619.82	370,591.17	15,025.17	3.48
Michigan	641,319.09	641,319.09		
Wisconsin	486,006.90	486,006.90		
Minnesota	390,265.83	390,265.83		
Iowa	931,504.70	931,504.70		
Missouri	4,673,764.39	2,476,793.88	2,196,837.66	132.85
South Dakota	342,730.95	342,730.95		
Nebraska	213,351.57	213,340.07		11.50
Total	9,294,219.56	7,081,263.59	2,211,862.83	1,093.14
Western division:				
North Dakota	818,660.35	818,519.94		140.41
Kansas	477,670.95	474,833.45	3,030.48	*192.98*
Montana	404,066.27	403,671.64		394.63
Idaho	342,994.81	342,701.29		293.52
Wyoming	153,892.80	153,848.18		44.62
Colorado	1,210,936.38	1,210,007.17		929.21
New Mexico	1,024,779.59	245,106.79	779,666.20	6.60
Arizona	1,629,189.65	66,154.60	1,562,722.50	312.55
Utah	200,984.83	201,241.50		*256.67*
Nevada	2,130.93	2,130.93		
Washington	82,039.37	82,114.19		*74.82*
Oregon	120,371.46	120,129.65		241.81
California	3,964,826.00	709,639.29	3,255,195.97	*9.26*
Total	10,432,543.39	4,830,098.62	5,600,615.15	1,829.62
Insular division:				
Alaska	238.34	238.34		
Hawaii	145,398.78	145,398.78		
Puerto Rico	1,479,248.82	1,479,248.82		
Total	1,624,885.94	1,624,885.94		
Undistributed	*64,095.03*	*52,599.07*	*51,495.96*	
Grand total	157,558,956.79	35,888,152.73	121,663,661.65	7,142.41

NOTE.—Italicized figures represent credits.

PAYMENTS TO PRODUCERS, JULY 1, 1938, TO JUNE 30, 1939, INCLUSIVE, FOR COOPERATING IN THE 1938 PROGRAM

	Total	Conservation payments	County associations
Southern division:			
South Carolina	$11,885,937.46	$11,275,564.91	$610,372.55
Georgia	16,047,288.84	14,865,230.80	1,182,058.04
Florida	2,869,086.85	2,680,184.76	188,902.09
Alabama	16,592,387.59	15,607,321.39	985,066.20
Mississippi	21,575,521.57	20,788,647.00	786,874.57
Arkansas	15,444,851.75	14,944,177.72	500,674.03
Louisiana	8,592,755.94	7,997,729.59	595,026.35
Oklahoma	14,972,760.54	13,968,604.01	1,004,156.53
Texas	53,300,734.55	50,880,190.33	2,420,544.22
Total	161,281,325.09	153,007,650.51	8,273,674.58
East Central division:			
Maryland	1,511,692.12	1,388,954.92	122,737.20
Delaware	577,965.24	555,377.96	22,587.28
Virginia	4,262,782.46	3,782,475.19	480,307.27
West Virginia	1,218,068.04	1,069,306.35	148,761.69
North Carolina	12,719,711.04	11,664,721.30	1,054,989.74
Kentucky	8,933,595.89	8,109,919.91	823,675.98
Tennessee	10,129,718.80	9,385,143.62	744,575.18
Total	39,353,533.59	35,955,899.25	3,397,634.34
Northeast division:			
Maine	1,896,734.18	1,803,943.48	92,790.70
New Hampshire	191,318.49	177,955.69	13,362.80
Vermont	537,178.88	526,839.88	10,339.00
Massachusetts	436,666.77	401,431.15	35,235.62
Rhode Island	34,965.34	32,039.23	2,926.11
Connecticut	441,867.19	418,427.87	23,439.32
New York	3,295,551.23	3,081,629.68	213,921.55
New Jersey	1,149,621.42	1,104,948.81	44,672.61
Pennsylvania	3,584,991.98	3,335,442.76	249,549.22
Total	11,568,895.48	10,882,658.55	686,236.93
North Central division:			
Ohio	8,832,450.20	7,799,294.92	1,033,155.28
Indiana	10,139,431.67	9,334,177.14	805,254.53
Illinois	18,091,704.97	16,974,494.98	1,117,209.99
Michigan	6,389,991.11	5,656,621.94	733,369.17
Wisconsin	9,525,443.34	8,889,423.02	636,020.32
Minnesota	15,418,798.09	14,567,960.41	850,837.68
Iowa	27,720,850.41	26,666,457.52	1,054,392.89
Missouri	11,133,145.53	9,743,603.65	1,389,541.88
South Dakota	13,742,562.67	13,059,399.23	683,163.44
Nebraska	13,033,909.61	11,993,196.08	1,040,713.53
Total	134,028,287.60	124,684,628.89	9,343,658.71
Western division:			
North Dakota	14,999,614.62	14,324,930.24	674,684.38
Kansas	14,992,925.41	14,199,053.03	793,872.38
Montana	4,945,664.49	4,594,825.72	350,838.77
Idaho	2,030,339.91	1,682,029.76	348,310.15
Wyoming	1,460,275.17	1,324,583.10	135,692.07
Colorado	3,228,630.21	2,855,269.91	373,360.30
New Mexico	1,449,676.86	1,259,269.52	190,407.34
Arizona	2,441,741.66	2,388,212.37	53,529.29
Utah	433,923.65	335,345.95	98,577.70
Nevada	119,723.18	99,918.04	19,805.14
Washington	3,260,062.59	3,034,773.13	225,289.46
Oregon	2,711,093.84	2,557,314.82	153,779.02
California	4,725,835.92	4,329,251.26	396,584.66
Total	56,799,507.51	52,984,776.85	3,814,730.66
Insular division:			
Alaska	1,008.60	1,008.60	
Hawaii	98,554.12	98,554.12	
Total	99,562.72	99,562.72	
Undistributed	*3,587.22*	*3,492.39*	*94.83*
Grand total	403,127,524.77	377,611,684.38	25,515,840.39

PAYMENTS TO PRODUCERS, JULY 1, 1938, TO JUNE 30, 1939, INCLUSIVE, FOR COOPERATING IN THE 1939 PROGRAM

	Total	Conservation payments	Payments, Price Adjustment Act of 1938	County associations
Southern division:				
South Carolina	$328,364.38	$100,989.88		$227,374.50
Georgia	430,988.14	661.71	$3,613.00	426,713.43
Florida	85,889.35			85,889.35
Alabama	444,810.85	33,782.62	479.71	410,548.52
Mississippi	285,328.09			285,328.09
Arkansas	316,113.92	61,605.77	3,960.38	250,547.77
Louisiana	262,060.72			262,060.72
Oklahoma	3,064,896.08		2,586,988.35	477,907.73
Texas	3,770,561.14		2,596,766.13	1,173,795.01
Total	8,989,012.67	197,039.98	5,191,807.57	3,600,165.12
East Central division:				
Maryland	355,722.26	1,660.94	301,734.42	52,326.90
Delaware	124,597.23		106,789.21	17,808.02
Virginia	642,925.62	380,259.33	85,592.65	177,073.64
West Virginia	465,004.78	397,603.21	30,160.21	37,241.36
North Carolina	804,936.17	127,581.16	39,228.51	638,126.50
Kentucky	1,029,895.88	636,997.12	73,050.33	319,848.43
Tennessee	785,710.42	342,518.75	91,162.24	352,029.43
Total	4,208,792.36	1,886,620.51	727,717.57	1,594,454.28
Northeast division:				
Maine	257,013.70	224,076.83		32,936.87
New Hampshire	207,871.94	191,633.91		16,238.03
Vermont	461,501.00	450,409.97		11,091.03
Massachusetts	139,023.18	117,343.39		21,679.79
Rhode Island	20,641.91	17,364.06		3,277.85
Connecticut	107,873.48	93,602.38		14,271.10
New York	237,996.35		59,483.94	178,512.41
New Jersey	41,481.76		343.44	41,138.32
Pennsylvania	631,973.49		378,078.57	253,894.92
Total	2,105,376.81	1,094,430.54	437,905.95	573,040.32
North Central division:				
Ohio	1,463,736.55		816,113.83	647,622.72
Indiana	1,308,708.37		825,296.70	483,411.67
Illinois	1,823,348.02		1,219,803.02	603,545.00
Michigan	965,838.50		498,103.90	467,734.60
Wisconsin	428,415.57			428,415.57
Minnesota	546,593.76	28,871.30	2,417.16	515,305.30
Iowa	807,071.82		240,103.95	566,967.87
Missouri	1,495,523.94		712,873.12	782,650.82
South Dakota	385,538.75		1,260.73	384,278.02
Nebraska	1,900,128.73	329.01	1,262,103.57	637,696.15
Total	11,124,904.01	29,200.31	5,578,075.98	5,517,627.72
Western division:				
North Dakota	645,715.64	274,820.05		370,895.59
Kansas	8,432,119.33		7,970,009.11	462,110.22
Montana	327,692.16	141,530.14		186,162.02
Idaho	756,312.81	518.81	558,453.72	197,340.28
Wyoming	81,014.18	754.56		80,259.62
Colorado	317,974.94	1,150.88	138,854.45	177,969.61
New Mexico	184,510.62		57,521.28	126,989.34
Arizona	41,038.31			41,038.31
Utah	109,845.93		60,383.75	49,462.18
Nevada	9,059.91			9,059.91
Washington	1,139,644.00	17,315.64	963,776.34	158,552.02
Oregon	1,200,926.00	36,233.75	1,058,763.06	105,929.19
California	444,346.09		82,776.84	361,569.25
Total	13,690,199.92	472,323.83	10,890,538.55	2,327,337.54
Grand total	40,118,285.77	3,679,615.17	22,826,045.62	13,612,624.98

TOTAL EXPENDITURES BY STATES, JULY 1, 1938, TO JUNE 30, 1939, INCLUSIVE

	Amount		Amount
Washington, D. C.	$6,548,007.22	Nevada	$155,124.74
Alabama	33,198,483.01	New Hampshire	414,262.33
Alaska	1,316.44	New Jersey	1,233,097.30
Arizona	4,172,099.25	New Mexico	2,771,921.38
Arkansas	28,971,142.48	New York	3,698,489.87
California	9,338,851.45	North Carolina	21,965,154.74
Colorado	4,954,289.63	North Dakota	16,795,920.82
Connecticut	565,808.24	Ohio	11,327,294.52
Delaware	707,502.50	Oklahoma	28,402,634.93
Florida	3,608,234.27	Oregon	4,170,288.82
Georgia	31,884,694.98	Pennsylvania	4,394,489.86
Hawaii	265,182.30	Philippine Islands	29,442.26
Idaho	3,328,686.84	Puerto Rico	1,842,356.02
Illinois	20,678,497.48	Rhode Island	59,007.90
Indiana	12,311,919.89	South Carolina	21,102,543.44
Iowa	29,918,225.09	South Dakota	14,836,082.78
Kansas	24,278,618.78	Tennessee	16,531,264.95
Kentucky	10,775,857.28	Texas	95,661,700.76
Louisiana	17,157,882.79	Utah	1,062,321.62
Maine	2,203,816.39	Vermont	1,021,203.49
Maryland	2,060,268.61	Virginia	6,162,155.72
Massachusetts	587,870.80	Washington	4,599,858.48
Michigan	8,410,417.83	West Virginia	1,845,992.28
Minnesota	16,746,930.16	Wisconsin	10,752,154.56
Mississippi	36,830,508.54	Wyoming	1,824,801.80
Missouri	17,764,488.94	Undistributed	242,639.43
Montana	5,891,571.72		
Nebraska	15,535,119.64	Total	621,598,497.35

GENERAL ADMINISTRATIVE EXPENSES JULY 1, 1938, TO JUNE 30, 1939, INCLUSIVE

1. BY OBJECTIVE CLASSIFICATION

	Total	Washington, D. C.	Field
Salaries	$13,572,558.12	$4,927,329.18	$8,645,228.94
Supplies	944,639.99	436,182.45	508,457.54
Communications	213,159.85	99,988.99	113,170.86
Travel	1,643,278.98	416,990.56	1,226,288.42
Transportation of things	246,005.92	88,401.19	157,604.73
Printing and binding[1]	2,239,255.05	311,048.90	1,928,206.15
Rents	210,570.73	29,547.37	181,023.36
Equipment	385,664.18	110,408.74	275,255.44
Miscellaneous	176,690.44	128,109.84	48,580.60
Total	19,631,823.26	6,548,007.22	13,083,816.04

2. BY AGRICULTURAL ADJUSTMENT ADMINISTRATION AND COOPERATING AGENCIES

Agricultural Adjustment Administration	$18,647,659.58	$5,967,046.90	$12,680,612.68
Extension Service	262,861.47	18,299.17	244,562.30
Forest Service	156,405.75	5,633.09	150,772.66
Bureau of Home Economics	685.46	685.46	
Library	3,240.00	3,240.00	
Office of Exhibits	*8.39*	*8.39*	
Office of Information	11,278.28	11,278.28	
Office of Land Use Planning	865.27	865.27	
Office of Solicitor	336,297.57	336,297.57	
Office of the Secretary	87,999.27	87,999.27	
Soil Conservation Service	2,999.03	2,800.73	198.30
Sugar Division	121,539.97	113,869.87	7,670.10
Total	19,631,823.26	6,548,007.22	13,083,816.04

[1] Including aerial photography.

NOTE.—Italicized figures represent credits.

MISCELLANEOUS EXPENDITURES, BY STATES, JULY 1, 1938, TO JUNE 30, 1939, INCLUSIVE

	Amount		*Amount*
Alabama	$85,024.85	New Mexico	$7,932.45
Arizona	7,771.50	New York	92.31
Arkansas	138,664.15	North Carolina	34,496.30
California	3,039.83	North Dakota	10,149.70
Colorado	3,990.01	Ohio	1,665.34
Delaware	271.93	Oklahoma	72,368.07
Florida	1,232.81	Oregon	759.89
Georgia	102,731.99	Philippine Islands	29,442.26
Idaho	3,047.37	Puerto Rico	834.10
Illinois	2,891.71	South Carolina	81,799.40
Indiana	2,000.19	South Dakota	6,680.52
Iowa	1,760.33	Tennessee	36,510.52
Kansas	7,853.80	Texas	373,337.57
Kentucky	2,834.48	Utah	652.06
Louisiana	52,964.11	Vermont	12.87
Maryland	226.16	Virginia	799.35
Michigan	439.14	Washington	3,130.74
Minnesota	1,610.21	West Virginia	141.21
Mississippi	175,712.86	Wisconsin	148.23
Missouri	18,529.55	Wyoming	613.88
Montana	6,207.52	Undistributed	*146,450.67*
Nebraska	7,320.82		
New Hampshire	1.36	Total	1,141,242.78

APPENDIXES

APPENDIX A.—1938 AGRICULTURAL CONSERVATION PROGRAM BULLETIN

[A compilation of the provisions of the 1938 Agricultural Conservation Program, including all amendments, effective as of October 10, 1939]

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Pursuant to the authority vested in the Secretary of Agriculture under Sections 7 to 17, inclusive, of the Soil Conservation and Domestic Allotment Act, as amended, and in connection with the effectuation of the purposes of Section 7 (a) of said Act in 1938, payments and grants of aid will be made for participation in the 1938 Agricultural Conservation Program in accordance with the provisions of this bulletin and such modifications thereof or other provisions as may hereafter be made.

The provisions of the 1938 Agricultural Conservation Program are necessarily subject to such legislation affecting said program as the Congress of the United States may hereafter enact; and the amount of such payments and grants of aid will necessarily be within the limits finally determined by such appropriation, the apportionment of such appropriations under the provisions of the Soil Conservation and Domestic Allotment Act as amended, and the extent of national participation. Under the provisions of Section 105 of the Agricultural Adjustment Act of 1938, as amended, payments under the 1938 Agricultural Conservation Program, based on soil-depleting crops for which special acreage allotments are established, shall be made at not less than 90 percent of the rates specified in the 1938 Agricultural Conservation Program Bulletin (ACP–1938), approved October 23, 1937. The rates specified herein with respect to potatoes, fire-cured and dark air-cured tobacco, and Georgia-Florida Type 62 tobacco are 90 percent of the rates approved for these commodities on October 23, 1937 and, therefore, will not be decreased. As an adjustment for participation the rates of payment and deduction with respect to each other commodity or item of payment may be decreased, and the rates of payment and deduction with respect to any commodity or item of payment may be increased, by as much as 10 percent.

The provisions of the 1938 Agricultural Conservation Program contained in this bulletin are not applicable to (1) Hawaii, Puerto Rico, and Alaska; (2) counties for which special agricultural conservation programs under said Act are approved for 1938 by the Secretary; and (3) public domain of the United States, including land owned by the United States and administered under the Taylor Grazing Act or by the Forest Service of the United States Department of Agriculture, and other lands in which the beneficial ownership is in the United States.

SECTION I. NATIONAL AND STATE ACREAGE ALLOTMENTS AND GOALS

A. NATIONAL GOALS

The national goals in connection with the 1938 Agricultural Conservation Program shall be as follows:

1. The following acreages of soil-depleting crops:

Cotton	27,000,000	to 29,000,000	acres
Corn	94,000,000	to 97,000,000	acres
Tobacco:			
Flue-cured	850,000	to 875,000	acres
Burley	440,000	to 460,000	acres
Fire-cured and dark air-cured	170,000	to 180,000	acres
Cigar filler and binder	85,000	to 90,000	acres
Georgia-Florida Type 62	2,800	to 3,000	acres
Potatoes	3,100,000	to 3,300,000	acres
Peanuts	1,500,000	to 1,600,000	acres
Rice	825,000	to 875,000	acres
Total soil-depleting crops	275,000,000	to 290,000,000	acres

2. The seeding and maintenance of soil-conserving crops on the cropland not required in 1938 for the growing of soil-depleting crops, the restoration, insofar as is practicable, of a permanent vegetative cover on 6,000,000 acres of land unsuited to the continued production of cultivated crops; and the carrying out of soil-building practices that will preserve and improve soil fertility and prevent wind and water erosion.

B. NATIONAL AND STATE ACREAGE ALLOTMENTS AND RESTORATION LAND GOALS

(1) **Total soil-depleting crops.**—The State acreage allotments of total soil-depleting crops are as follows:

	Acres		*Acres*
Alabama	7,409,054	Nevada	63,148
Arizona	435,470	New Hampshire	50,827
Arkansas	6,527,684	New Jersey	569,414
California	5,084,539	New Mexico	1,824,761
Colorado	6,220,571	New York	2,961,966
Connecticut	126,796	North Carolina	5,638,277
Delaware	325,710	North Dakota	17,646,443
Florida	1,271,278	Ohio	7,137,725
Georgia	8,707,615	Oklahoma	14,510,788
Idaho	2,733,292	Oregon	2,895,948
Illinois	14,994,167	Pennsylvania	3,852,803
Indiana	8,049,712	Rhode Island	21,823
Iowa	16,369,718	South Carolina	4,892,425
Kansas	22,586,216	South Dakota	12,751,598
Kentucky	4,316,105	Tennessee	4,871,620
Louisiana	4,376,720	Texas	29,420,722
Maine	362,980	Utah	776,675
Maryland	1,325,043	Vermont	201,837
Massachusetts	143,694	Virginia	2,807,359
Michigan	5,313,677	Washington	4,805,861
Minnesota	13,839,942	West Virginia	832,893
Mississippi	6,959,607	Wisconsin	6,485,646
Missouri	9,789,388	Wyoming	1,116,141
Montana	5,777,709		
Nebraska	15,157,876	Total	294,159,263

(2) **Cotton.**—The State acreage allotments of cotton are as follows:

	Acres		*Acres*
Alabama	2,267,810	Missouri	391,188
Arizona	200,383	New Mexico	112,492
Arkansas	2,466,032	North Carolina	1,005,505
California	406,884	Oklahoma	2,397,256
Florida	89,349	South Carolina	1,390,768
Georgia	2,229,799	Tennessee	829,642
Illinois	5,547	Texas	10,429,865
Kansas	1,032	Virginia	59,576
Kentucky	20,387		
Louisiana	1,268,259	Total	28,285,572
Mississippi	2,713,798		

(3) **Corn.**—The State acreage allotments of corn in the commercial corn area are as follows:

	Acres		*Acres*
Illinois	7,348,375	Missouri	3,267,079
Indiana	3,456,203	Nebraska	6,757,334
Iowa	9,249,232	Ohio	2,521,771
Kansas	2,108,595	South Dakota	1,635,790
Kentucky	150,507	Wisconsin	452,809
Michigan	223,790		
Minnesota	3,319,794	Total	40,491,279

(4) **Wheat.**—The State acreage allotments of wheat are as follows:

	Acres		Acres
Alabama	5,710	New Jersey	52,990
Arizona	35,375	New Mexico	356,665
Arkansas	77,060	New York	246,779
California	708,656	North Carolina	413,024
Colorado	1,504,623	North Dakota	9,431,355
Delaware	77,489	Ohio	1,870,407
Georgia	139,664	Oklahoma	4,291,784
Idaho	1,011,604	Oregon	867,859
Illinois	2,039,411	Pennsylvania	873,098
Indiana	1,689,970	South Carolina	125,611
Iowa	456,037	South Dakota	3,345,403
Kansas	12,519,879	Tennessee	381,981
Kentucky	382,542	Texas	4,146,240
Maine	6,047	Utah	239,656
Maryland	395,014	Vermont	118
Michigan	765,831	Virginia	546,728
Minnesota	1,609,218	Washington	1,912,506
Mississippi	84	West Virginia	130,091
Missouri	1,938,358	Wisconsin	108,001
Montana	3,973,939	Wyoming	343,971
Nebraska	3,466,075		
Nevada	13,147	Total	62,500,000

(5) **Tobacco.**—The national and State acreage allotments of each kind of tobacco are as follows:

(I) FLUE-CURED TOBACCO

	Acres
Alabama	400
Florida	13,700
Georgia	83,000
North Carolina	590,000
South Carolina	95,000
Virginia	91,500
Total	873,600

(II) BURLEY TOBACCO

	Acres
Alabama	188
Arkansas	75
Georgia	175
Illinois	50
Indiana	12,650
Kansas	560
Kentucky	311,000
Missouri	6,900
North Carolina	9,700
Ohio	16,900
Oklahoma	7
South Carolina	125
Tennessee	76,100
Virginia	12,800
West Virginia	5,050
Total	452,280

(III) FIRE-CURED AND DARK AIR-CURED TOBACCO

	Acres
Indiana	500
Kentucky	88,900
Tennessee	55,500
Virginia	26,300
Total	171,200

(IV) CIGAR FILLER AND BINDER TOBACCO

Connecticut	12,077
Florida	818
Georgia	307
Illinois	20
Indiana	130
Massachusetts	4,914
Minnesota	780
New Hampshire	54
New York	927
Ohio	19,092
Pennsylvania	24,903
Vermont	27
Wisconsin	23,150
Total	87,199

(V) GEORGIA-FLORIDA TYPE 62 TOBACCO

	Acres
Florida	2,349
Georgia	551
Total	2,900

(6) **Rice.**—The State acreage allotments of rice are as follows:

	Acres		Acres
Arkansas	155,728	Texas	167,272
California	105,094		
Louisiana	421,396	Total	850,000
Missouri	510		

(7) **Peanuts.**—The national and State acreage allotments of peanuts in the commercial areas are as follows:

	Acres		Acres
Alabama	272,500	Texas	167,000
Florida	50,500	Virginia	134,270
Georgia	475,000		
North Carolina	211,040	Total	1,330,310
Oklahoma	20,000		

(8) **Potatoes.**—The State acreage allotments of commercial potatoes are as follows:

	Acres		Acres
Alabama	1,866	New Hampshire	2,149
California	45,520	New Jersey	52,462
Colorado	84,143	New York	115,965
Connecticut	9,312	North Carolina	35,134
Delaware	1,159	North Dakota	88,442
Florida	17,372	Ohio	37,474
Georgia	1,038	Oklahoma	5,267
Idaho	98,826	Oregon	30,744
Indiana	15,000	Pennsylvania	72,353
Kansas	9,398	Rhode Island	2,486
Kentucky	5,947	South Carolina	10,324
Maine	158,271	South Dakota	12,508
Maryland	11,518	Utah	5,488
Massachusetts	6,447	Vermont	1,938
Michigan	150,572	Virginia	51,000
Minnesota	179,954	Washington	27,544
Missouri	9,069	Wisconsin	126,506
Montana	4,790	Wyoming	19,981
Nebraska	62,229		
Nevada	1,135	Total	1,571,331

(9) **Restoration land goals.**—The State restoration land goals are as follows:

	Acres		Acres
Colorado	1,375,000	Oklahoma	300,000
Kansas	750,000	South Dakota	550,000
Montana	875,000	Texas	425,000
Nebraska	425,000	Wyoming	125,000
New Mexico	150,000		
North Dakota	1,025,000	Total	6,000,000

SECTION II. COUNTY ACREAGE ALLOTMENTS AND GOALS

A. COUNTY ACREAGE ALLOTMENTS OF SOIL-DEPLETING CROPS

The Agricultural Adjustment Administration with the assistance of State committees shall establish county acreage allotments for total soil-depleting crops, and for cotton, corn, wheat, tobacco, potatoes, and peanuts for market, and goals for restoration land as hereinafter set forth. The soil-depleting acreage allotments for all counties in each State shall not exceed the applicable acreage allotment established for the State by the Secretary except as otherwise provided in this bulletin.

1. **Total soil-depleting acreage allotments.**—County acreage allotments of total soil-depleting crops shall be established by distributing the State acreage allotment of total soil-depleting crops among the counties in the State on the basis of the average acreage of soil-depleting crops grown in such counties in whichever of the periods of five or more consecutive years since 1927 the Agricultural Adjustment Administration finds is most representative of normal conditions

and the base acreages of total soil-depleting crops established in connection with the 1937 Agricultural Conservation Program, adjusted where necessary for farms for which provision was not made in 1937, with due allowance for trends in acreage of soil-depleting crops, farms for which the general crop acreage allotment will be as large as the usual acreage of general soil-depleting crops, and the relationship of the usual acreage of individual soil-depleting crops to the 1938 acreage allotments in counties where allotments for individual soil-depleting crops are established.

2. **Cotton acreage allotments.**—(a) County acreage allotments for cotton shall be determined as follows: The State acreage allotment of cotton (less 2 percent or such smaller part thereof as the Agricultural Adjustment Administration determines shall be required in the State in making allotments to farms on which cotton will be planted in 1938 but on which cotton was not planted in any of the years 1935, 1936 and 1937) shall be prorated among the counties in the State on the basis of the acreage planted to cotton during the five years, 1933 to 1937, inclusive, plus, in the applicable years, the acreage diverted from the production of cotton under agricultural adjustment and conservation programs; *Provided*, That there shall be added to the acreage allotment for each county so determined the number of acres, if any, required to provide an acreage allotment in such county of not less than 60 percent of the sum of (1) the acreage planted to cotton in such county in 1937, and (2) the acreage therein diverted from the production of cotton in 1937 under the agricultural conservation program.

(b) In any county where the Agricultural Adjustment Administration finds that there are one or more administrative areas which, because of differences in types, kinds and productivity of the soil or other conditions, shall be treated separately in order to prevent discrimination, the county acreage allotment shall be apportioned pro rata among such administrative areas on the basis of the acreage planted to cotton in 1937 plus the acreage diverted from the production of cotton under the 1937 Agricultural Conservation Program, or if the Agricultural Adjustment Administration determines that conditions affecting the acreage planted to cotton were not reasonably uniform throughout the county in 1937, then on the basis of the cotton soil-depleting base acreages established under the 1937 Agricultural Conservation Program. Allotments to the farms within each such administrative area shall be made by distributing the allotment for such administrative area in the manner provided in Section III for the apportionment of cotton county acreage allotments among farms.

3. **Corn acreage allotments.**—County acreage allotments of corn for counties in the commercial corn-producing area shall be established by distributing the State acreage allotment of corn among such counties in such State pro rata on the basis of the acreage of corn seeded for the production of corn in such counties during the ten years, 1928 to 1937, inclusive, plus, in applicable years, the acreage diverted under agricultural adjustment and conservation programs. If, on account of abnormal weather conditions, the acreage seeded to corn in a county in any year of such ten-year period was less than 50 percent or more than 150 percent of the average for the other nine years, such year shall be eliminated in calculating the average acreage seeded to corn for such county. The average acreage seeded in any county so determined shall be adjusted for trends in acreage by giving due consideration to the average annual increase or decrease in the acreage seeded to corn in the county as indicated by the acreage seeded to corn and diverted from the production of corn under agricultural adjustment and conservation programs during the last five years of the period 1928 to 1937, inclusive, as compared with the acreage seeded to corn during the first five years of such period.

4. **Wheat acreage allotments.**—County acreage allotments of wheat shall be established by distributing the State acreage allotment of wheat among the counties in such State pro rata on the basis of the acreage of wheat seeded for the production of wheat during the ten years, 1928 to 1937, inclusive, plus in applicable years the acreage diverted under agricultural adjustment and conservation programs. If, on account of abnormal weather conditions, the acreage seeded for the production of wheat in a county in any year of such ten-year period was less than 50 percent or more than 150 percent of the average computed for the other nine years, such year shall be eliminated in calculating the average acreage seeded for the production of wheat in such county. The average acreage seeded in any county for the production of wheat so deter-

mined shall be adjusted for trends in acreage by giving equal weight to the acreages seeded for the production of wheat and the acreages diverted from the production of wheat during the years 1935, 1936, and 1937, and to the acreages so seeded and diverted during the ten-year period 1928 to 1937, inclusive, as adjusted for abnormal weather conditions.

5. **Tobacco acreage allotments.**—County acreage allotments for each kind of tobacco shall be established by distributing the State acreage allotment of such kind of tobacco among the counties in the State on the basis of the base acreages of such kind of tobacco established for such counties under the 1937 Agricultural Conservation Program, taking into consideration allotments for small farms, trends in acreage, seed bed, and other plant diseases.

6. **Potato acreage allotments.**—County acreage allotments of potatoes for counties in the areas designated by the Agricultural Adjustment Administration as commercial potato-producing areas shall be established by distributing the State acreage allotment of potatoes among such counties in such State pro rata on the basis of the average acreage devoted to potatoes in such counties during the years 1933 to 1937, inclusive, taking into consideration trends in acreage on commercial potato-producing farms as reflected by the acreage planted to potatoes in 1937, as compared with the average acreage planted during such five-year period and also taking into consideration the acreage of potatoes on non-commercial potato-producing farms.

7. **Peanut acreage allotments.**—County acreage allotments of peanuts for market for counties in the areas designated by the Agricultural Adjustment Administration as commercial peanut-producing areas shall be established by distributing the State acreage allotment of peanuts among such counties in such State pro rata on the basis of the base acreages for peanuts established for such counties under the 1937 Agricultural Conservation Program, taking into consideration trends in acreage on commercial peanut-producing farms.

B. COUNTY RESTORATION LAND GOALS

County goals for restoration land shall be established by distributing the applicable State restoration land goal among the counties in the areas designated by the Agricultural Adjustment Administration as areas subject to serious wind erosion and areas containing large acreages unsuited to continued production of cultivated crops, on the basis of the amount of land in such counties which was cropped at least once since January 1, 1930, but on which, because of its physical condition and texture and because of climatic conditions, a permanent vegetative cover should be restored.

C. COUNTY SOIL-BUILDING GOALS

Insofar as practicable, county goals shall be established for particular soil-building practices which are not routine farming practices and which are most needed in the county in order to preserve and improve soil fertility and to prevent wind and water erosion.

SECTION III. FARM ACREAGE ALLOTMENTS AND GOALS

The county committee, with the assistance of other local committees in the county, shall determine acreage allotments, restoration land goals, and soil-building practice goals, in accordance with provisions contained herein and instructions issued by the Agricultural Adjustment Administration. The soil-depleting acreage allotments determined for the farms in a county shall not exceed the applicable county acreage allotments established for the county by the Agricultural Adjustment Administration, and the sum of the acreage allotments for farms furnishing required forms and information shall not exceed their proportionate share of the county acreage allotments.

A. SOIL-DEPLETING ACREAGE ALLOTMENTS

1. **Total soil-depleting acreage allotment.**—The total soil-depleting acreage allotment for any farm shall be established on the basis of good soil management, tillable acreage on the farm, type of soil, topography, degree of erosion, the acreage of all soil-depleting crops customarily grown on the farm, and when the Agricultural Adjustment Administration finds it applicable, the acreage of food and feed crops needed for home consumption on the farm, taking

into consideration allotments established for individual soil-depleting crops. The total soil-depleting acreage allotment for any farm shall be comparable with the allotments determined for other farms in the same community which are similar with respect to such factors.

2. **Cotton allotment.**—(a) County cotton acreage allotments shall be apportioned among the farms in the county on which cotton was planted in any one of the years 1935, 1936, and 1937, in a manner that will result in a cotton acreage allotment for each such farm which is a percentage (which shall be the same percentage for all farms in the county or administrative area) of the land in the farm in 1937 which was tilled annually or in regular rotation exclusive of the acres of such land normally devoted to the production of sugarcane for sugar, wheat, tobacco, or rice for market, or wheat or rice for feeding to livestock for market except that:

(1) For any such farm with respect to which the highest acreage planted to cotton and diverted from the production of cotton in any one of the three years 1935, 1936, and 1937, is five acres or less, the cotton acreage allotment for the farm shall be such highest number of acres if the county cotton acreage allotment is sufficient therefor;

(2) For any such farm with respect to which the highest number of acres planted to cotton and diverted from the production of cotton in any one of the three years 1935, 1936, and 1937, is more than five acres, the allotment for the farm shall not be less than five acres if the county cotton acreage allotment is sufficient therefor;

(3) Notwithstanding the foregoing provisions of this paragraph (a), a number of acres equal to not more than 3 percent of the county acreage allotment in excess of the allotments made to farms on which the highest number of acres planted to cotton plus the acres diverted from the production of cotton in any of the years 1935, 1936, and 1937, was five acres or less and the number of acres required for allotments of five acres for each other farm in the county on which cotton was planted in 1935, 1936, or 1937 may be apportioned among farms in the county on which cotton was planted in 1935, 1936, or 1937, and for which the allotment otherwise provided is five acres or more but less than 15 acres and less than the highest number of acres planted to cotton and diverted from the production of cotton in any one of the years 1935, 1936, and 1937.

In making such allotments under clause (3) in the preceding sentence consideration shall be given to the land, labor, and equipment available for the production of cotton, crop rotation practices, and the soil and other facilities affecting the production of cotton and such increases shall not be such as to increase the allotment to any farm above 15 acres. In no event shall the allotment for any farm under this paragraph (a) exceed the highest number of acres planted to cotton and diverted from the production of cotton in any one of the three years 1935, 1936, and 1937.

(b) In case the county allotment is insufficient to provide allotments to farms in the county, which are determined, under instructions issued by the Agricultural Adjustment Administration, to be adequate and representative in view of their past production of cotton and their tilled land, there shall be apportioned to such farms, under instructions issued by the Agricultural Adjustment Administration, such part of a State reserve equal to 4 percent of the State acreage allotment as is necessary to give such farms allotments in conformity with paragraph (a) which are as nearly adequate and representative as such 4-percent reserve will permit. Such additional allotment shall be used first to increase allotments to farms under clauses (1) and (2) of paragraph (a).

(c) Notwithstanding the provision of paragraph (a) above the cotton acreage allotment for any farm shall be increased by such amount as may be necessary to provide an allotment of not less than 50 percent of the sum of the acreage as determined by the county committee to have been planted in cotton in 1937 and the acreage diverted from cotton production in 1937 under the agricultural conservation program provided that the cotton acreage allotment for any farm shall not be increased under this paragraph to more than 40 percent of the acreage on such farm which is tilled annually or in regular rotation.

(d) That portion of the State acreage allotment not apportioned among the counties under Section II, subsection A, paragraph 2 (a), hereof shall be apportioned to farms in the State on which cotton will be planted in 1938 but

on which cotton was not planted in any of the years 1935, 1936, and 1937, so as to result in comparable allotments to farms similar with respect to land, labor, and equipment available for the production of cotton, crop rotation practices, and the soil and other physical facilities affecting the production of cotton. The county committee shall report, through the State committee, to the Agricultural Adjustment Administration the acreage required for the allotments to such farms in the county together with such substantiating data as may be required by the Agricultural Adjustment Administration, and the Agricultural Adjustment Administration shall allot to the county the proportion of that part of the State acreage allotment reserved for this purpose which it finds reasonable on the basis of the data so reported.

3. **Corn allotment.**—Acreage allotments of corn shall be determined for farms in the commercial corn-producing area on the basis of tillable acreage, crop rotation practices, type of soil and topography. The allotment for any farm shall be comparable to the allotments recommended for other farms in the same community which are similar with respect to such factors.

4. **Wheat allotment.**—Acreage allotments of wheat shall be determined for farms on which wheat has been seeded for harvest in one or more of the years 1935, 1936, and 1937, on the basis of tillable acreage, crop rotation practices, type of soil and topography. Not more than 3 percent of the county wheat acreage allotment shall be apportioned to farms in such county on which wheat was not seeded for harvest in any one of the three years 1935, 1936, and 1937, on the basis of tillable acreage, crop rotation practices, type of soil and topography. The wheat acreage allotment for any farm shall be comparable with the allotment determined for other farms in the same community which are similar with respect to such factors. No allotment shall be established for any class B farm for which the normal production of wheat for market is less than 100 bushels.

5. **Tobacco allotment.**—Acreage allotments for each kind of tobacco shall be determined on the basis of past acreage of each kind of tobacco with due allowance for the effects of abnormal weather conditions and plant-bed and other diseases; land, labor, and equipment available for the production of tobacco; crop rotation practices; and the soil and other physical factors affecting the production of tobacco. The tobacco acreage allotment for any farm on which tobacco was grown in one or more of the years 1934 to 1937, inclusive, shall be comparable with the allotments for other farms in the same community which are similar with respect to such factors: *Provided*, That in the case of flue-cured, Burley, and fire-cured and dark air-cured tobacco, special consideration shall be given to farms for which acreage allotments are small. The allotment for any farm on which tobacco is to be produced in 1938 for the first time since 1933 shall not exceed 75 percent of the allotment for other farms in the same community on which tobacco was produced since 1933 which are similar with respect to land, labor, and equipment available for the production of tobacco; crop rotation practices, and the soil and other physical factors affecting the production of tobacco.

6. **Potato allotment.**—In counties included in the commercial potato-producing areas allotments shall be determined for each farm normally producing potatoes excluding farms on which the acreage normally planted to potatoes for market is determined to be less than three acres. No potato acreage allotment shall be less than three acres. Potato acreage allotments shall be established on the basis of good soil management, tillable acreage on the farm, type of soil, topography, degree of erosion, production facilities, and the acreage of potatoes customarily grown on the farm. The potato acreage allotment for any farm shall be comparable with the allotments for other farms in the same community which are similar with respect to such factors.

7. **Peanut allotment.**—In counties included in the commercial peanut-producing area peanut acreage allotments shall be determined on the basis of good soil management, tillable acreage on the farm, type of soil, topography, degree of erosion, and the acreage of peanuts for market customarily grown on the farm. The peanut acreage allotment for any farm shall be comparable with the allotments for other farms in the same community which are similar with respect to such factors.

8. **Rice allotment.**—(a) A rice acreage allotment shall be determined for each farm on which rice is grown in 1938 on the basis of the rice acreage apportioned

to the persons participating in the production of rice on such farm in 1938 and allocated by them to such farm, the acreage on the farm suited to rice production and for which water is readily available, and the acreage of rice customarily grown by such persons. The rice acreage allotment for any farm shall be comparable with the allotments for other farms in the same community which are similar with respect to such factors.

(b) The State rice acreage allotment (less 1 percent or such smaller part thereof as the Agricultural Adjustment Administration determines shall be required in the State for apportionment as provided in paragraph (c) below) shall be apportioned by the State committee, in accordance with instructions issued by the Agricultural Adjustment Administration, among the persons in the State who are participating in the production of rice in 1938 on the basis of their production of rice during the years 1933 to 1937, inclusive; land, labor, equipment, and water available for the production of rice; crop rotation practices, soil fertility, and other physical factors affecting the production of rice.

(c) That portion of the State rice acreage allotment not apportioned among farms pursuant to paragraph (b) above, shall be apportioned by the State committee, in accordance with instructions issued by the Agricultural Adjustment Administration, among the persons in the State who are participating in the production of rice in 1938 but who did not participate in the production of rice in any one of the years 1933 to 1937, inclusive, on the basis of land, labor, equipment, and water available for the production of rice; crop rotation practices, soil fertility, and other physical factors affecting the production of rice.

B. RESTORATION LAND AND SOIL-BUILDING GOALS

1. **Restoration-land goal.**—Restoration-land goals shall be determined on the basis of the land on the farm which has been cropped at least once since January 1, 1930, but on which, because of its physical condition and texture and because of climatic conditions, a permanent vegetative cover should be restored.

2. **Soil-building goal.**—The soil-building goal for any farm shall be the number of units of soil-building practices equal to two-thirds of the number of dollars computed for the farm under Section IV, subsection C, with respect to the soil-conserving acreage for class A farms, the acreage of cropland with respect to which a payment of 70 cents per acre is computed for class B farms, and the commercial vegetable acreage, commercial orchards, and noncrop pasture land for all farms. The goal so established shall represent the number of units of applicable practices to be carried out on the farm. Insofar as practicable, the county committee shall determine for individual farms practices to be followed in meeting the goal which are not routine farming practices on the farm but which are needed on the farm in order to preserve and improve soil fertility and prevent wind and water erosion, and which will tend to accomplish the goals, if any, established for the county with respect to particular soil-building practices.

C. POSTING OF ACREAGE ALLOTMENTS

All acreage allotments established for farms in a county shall be posted or kept freely available for public inspection in the office of the county committee or county agricultural extension agent.

SECTION IV. PAYMENT FOR FULL PERFORMANCE

Payment will be made with respect to any farm for not exceeding soil-depleting acreage allotments, and for achieving soil-building and restoration land goals in an amount which shall be the sum of the following.

A. SOIL-DEPLETING ACREAGE ALLOTMENTS

1. **Cotton.**—2.4 cents per pound of the normal yield per acre of cotton for the farm for each acre in the cotton acreage allotment; or, if the acreage planted to cotton is less than 80 percent of the cotton acreage allotment and the county committee finds that the failure to plant 80 percent of such cotton acreage allotment was not due to flood or drought, for 125 percent of the acreage planted to cotton. The acreage planted to cotton shall be deemed to be that acreage which is seeded to cotton and classified as soil-depleting and also, for the purposes of this provision, that acreage seeded to cotton which is seriously

damaged or destroyed by flood, drought, hail, insects, or other uncontrollable natural causes but is not classified as soil-depleting.

2. **Corn.**—10 cents per bushel of the normal yield per acre of corn for the farm for each acre in the corn acreage allotment; or, if the acreage planted to corn is less than 80 percent of the corn acreage allotment and the county committee finds that the failure to plant 80 percent of such corn acreage allotment was not due to flood or drought for 125 percent of the acreage planted to corn. The acreage planted to corn shall be deemed to be that acreage which is seeded to corn classified as soil-depleting (excluding (1) any acreage of sweet corn contracted to be sold for canning; (2) any acreage of sweet corn sold for canning or roasting ears; (3) any acreage of sweet corn to be sold or used as seed; and (4) any acreage of popcorn sold as popcorn or to be sold or used as seed).

3. **Wheat.**—12 cents per bushel of the normal yield per acre of wheat for the farm for each acre in the wheat acreage allotment; or, if the acreage planted to wheat is less than 80 percent of the wheat acreage allotment and the county committee finds that the failure to plant 80 percent of such wheat acreage allotment was not due to flood or drought, for 125 percent of the acreage planted to wheat. The acreage planted to wheat shall be deemed to be that acreage which is seeded to wheat classified as soil-depleting under subsection B of Section XIII.

4. **Tobacco.**—The following number of cents per pound of the normal yield per acre of tobacco for the farm for each acre in the tobacco acreage allotment for each of the following kinds of tobacco:

(a) Burley	0.5 cent
(b) Flue-cured	1.0 cent
(c) Fire-cured and dark air-cured	1.53 cents
(d) Cigar filler and binder	1.0 cent
(e) Georgia-Florida Type 62	1.8 cents

Provided, That in the case of cigar filler and binder tobacco, if the acreage planted to such kind of tobacco is less than 80 percent of the acreage allotment therefor and the county committee finds that the failure to plant 80 percent of the acreage allotment was not due to flood, drought, or plant-bed diseases, the payment shall be computed on 125 percent of the acreage planted to cigar filler and binder tobacco.

5. **Potatoes.**—In early potato-producing areas, 5.4 cents, and in late potato-producing areas, 3.6 cents per bushel of the normal yield of potatoes for the farm for each acre of potatoes planted on the farm in 1938 not in excess of the potato acreage allotment. The acreage planted to potatoes shall be deemed to be that acreage which is seeded to potatoes.

6. **Peanuts.**—0.2 of a cent per pound of the normal yield per acre of peanuts for the farm for each acre in the peanut acreage allotment.

7. **Rice.**—0.125 of a cent per pound of the normal yield per acre of rice for the farm for each acre in the rice acreage allotment, or if the acreage planted to rice is less than 80 percent of the rice acreage allotment and the county committee finds that failure to plant 80 percent of such rice acreage allotment was not due to flood or drought, for 125 percent of the acreage planted to rice. The acreage planted to rice shall be deemed to be that acreage which is seeded to rice.

8. **General soil-depleting crops on class A farms.**—$1.25 per acre, adjusted for productivity, for each acre in the total soil-depleting acreage allotment established for the farm in excess of the sum of (1) the acreages used in computing payments with respect to the corn, wheat, potato, rice, peanut, cigar filler and binder tobacco, and Georgia-Florida Type 62 tobacco acreage allotments established for the farm; (2) 1¼ times the acreages used in computing payments with respect to the cotton, flue-cured tobacco, Burley tobacco, and fire-cured and dark air-cured tobacco acreage allotments established for the farm; and (3) the acreage of sugar beets planted on the farm in 1938.

B. RESTORATION LAND GOALS

(1) 50 cents per acre for each acre in the restoration land goal established for the farm.

C. PAYMENTS IN CONNECTION WITH SOIL-BUILDING PRACTICES

(1) 50 cents per acre of cropland in the farm in excess of the total soil-depleting acreage allotment for the farm (applicable only to class A farms).

(2) $1.50 per acre of the average acreage of land on which commercial vegetables were grown on the farm in 1936 and 1937.

(3) $2.00 per acre of commercial orchards on the farm January 1, 1938.

(4) (a) 2 cents per acre of noncrop open pasture land in the farm, plus $1.00 for each animal unit of grazing capacity (on a 12-month basis) of such pasture, in the North Central Region and in Kansas, Oklahoma, Texas, and California.

(b) 3 cents per acre of noncrop open pasture land plus 75 cents for each animal unit of grazing capacity (on a 12-month basis) of such pasture, in North Dakota, Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Idaho, Oregon, and Washington.

(c) 25 cents per acre of fenced noncrop open pasture land in excess of one-half of the number of acres of cropland in the farm which is capable of maintaining during the normal pasture season at least one animal unit for each five acres of such pasture land, in the East Central Region and States other than Texas and Oklahoma in the Southern Region.

(d) 40 cents per acre of fenced noncrop open pasture land, in excess of one-half of the number of acres of cropland in the farm, which is capable of maintaining during the normal pasture season at least one animal unit for each five acres of such pasture land, in the Northeast Region.

(5) 70 cents per acre of cropland on any class B farm in excess of the sum of (1) the acreages used in computing payments with respect to the corn, wheat, potato, rice, peanut, cigar filler and binder tobacco, and Georgia-Florida Type 62 tobacco acreage allotments established for the farm; (2) 1½ times the acreages used in computing payments with respect to the cotton, flue-cured tobacco, Burley tobacco, and fire-cured and dark air-cured tobacco acreage allotments established for the farm; (3) the acreage of sugar beets and sugarcane for sugar planted on the farm in 1938; and (4) in the Western Region, the normal acreage of summer fallow for the farm, not in excess of the wheat acreage allotment established for the farm.

SECTION V. PAYMENTS FOR PARTIAL PERFORMANCE

Payments computed for any farm under the provisions of Section IV shall be subject to all of the following deductions which are applicable to the farm: *Provided*, That in any case where, through error in a county or State office, the producer was officially notified in writing, prior to completion of planting, of an acreage allotment larger than the finally approved acreage allotment and was not notified of the finally approved acreage allotment until after planting was completed, and the county committee finds that the producer, acting solely upon information contained in the erroneous notice, planted an acreage of soil-depleting crops in excess of the finally approved acreage allotment, such deduction for excess acreage of soil-depleting crops will be made only with respect to the acreage in excess of the allotment erroneously issued.

A. DEDUCTIONS FOR EXCESS ACREAGES OF SOIL-DEPLETING CROPS

1. **Cotton.**—5 cents per pound of the normal yield for the farm for each acre of cotton in excess of the cotton acreage allotment: *Provided*, That in any county where producers were unofficially notified of the percentage to be applied to the adjusted tilled acreage in determining cotton acreage allotments, both on the basis of administrative areas in the county and on a county-wide basis, and planted cotton acting solely on the basis of the unofficial notification, and wherein official notices of the correct cotton acreage allotments computed on the basis of a county-wide percentage were not available until after planting time, the deduction will be made only with respect to the acreage planted to cotton in excess of the larger of the allotment computed on the basis of a county-wide percentage, or the allotment computed on the basis of administrative areas.

2. **Corn.**—5 times the payment rate specified in Section IV for the normal yield for the farm on the acreage by which the corn acreage exceeds the corn acreage allotment.

3. **Tobacco, potatoes, and peanuts.**—(a) 5 times the payment rate specified in Section IV for the normal yield for the farm on the acreages by which the fire-cured and dark air-cured tobacco acreages exceed the acreage allotment for such types of tobacco.

(b) 6 times the payment rate specified in Section IV for the normal yield for the farm on the acreage by which the acreage of peanuts for market exceeds the peanut acreage allotment.

(c) 10 times the payment rate specified in Section IV for the normal yield for the farm on the acreages by which the acreages of flue-cured tobacco, Burley tobacco, cigar filler and binder tobacco, Georgia-Florida Type 62 tobacco, and potatoes exceed the respective acreage allotments established for such crops and on farms for which potato acreage allotments are not established in designated commercial areas on each acre by which the acreage of potatoes for market exceeds three acres.

4. **Rice.**—8 times the payment rate specified in Section IV for the normal yield for the farm on the acreage by which the rice acreage exceeds the rice acreage allotment.

5. **Commercial vegetables.**—In counties designated by the Agricultural Adjustment Administration as counties where commercial vegetables and potatoes or commercial vegetables and cigar filler (type 41) or binder (types 51, 52, and 53) tobacco are grown generally on the same farms, a deduction shall be made from the payment with respect to any farm having a potato or cigar filler and binder tobacco acreage allotment, for each acre on which commercial vegetables are grown in 1938 in excess of the annual average acreage on which commercial vegetables were grown on the farm in 1936 and 1937 (adjusted, where necessary, for the effect of abnormal weather conditions on plantings in such years), such deduction to be at the rate applicable to the farm under this Section V with respect to potatoes or cigar filler and binder tobacco whichever is less. On farms where adjustments for abnormal weather conditions are made in the acreage of commercial vegetables grown in 1936 and 1937 as provided in this item 5, such adjusted acreage shall also be used under item 2 of subsection C of Section IV in computing the payment with respect to the farm.

6. **Total soil-depleting acreage allotments.**—The following applicable rate for each acre of land classified as soil-depleting in excess of the total soil-depleting acreage allotment, less the acreages for which deductions are made under items 1 to 5, inclusive, of this subsection A: *Provided*, That the deduction specified in subdivision (c) of this item 6 shall not apply in any county in which the regional director determines that the planting of general soil-depleting crops was substantially completed prior to the time notices of total soil-depleting acreage allotments were mailed or made available to farm operators in the county.

(a) 5 times the rate of payment with respect to the wheat acreage allotment if a payment is computed for the farm under Section IV with respect to a wheat acreage allotment.

(b) 5 times the rate of payment with respect to general soil-depleting crops if the farm is a class A farm and no payment is computed for the farm under Section IV with respect to a wheat acreage allotment.

(c) $4.00 per acre if the farm is a class B farm and a payment is computed for the farm under Section IV with respect to a cotton, corn, tobacco peanut, potato, or rice acreage allotment but no payment is computed for the farm under Section IV with respect to a wheat acreage allotment.

B. DEDUCTIONS FOR FAILURE TO CARRY OUT SOIL-BUILDING PRACTICES AND CONSERVATION MEASURES

1. $1.50 for each unit by which the soil-building goal is not reached.

2. $1.00 for each acre of restoration land on which there are not carried out in 1938 conservation measures specified by the county committee in accordance with instructions issued by the Agricultural Adjustment Administration.

C. DEDUCTION FOR FAILURE TO PREVENT WIND AND WATER EROSION

$1.00 for each acre of land, other than restoration land, in an area designated by the Agricultural Adjustment Administration as subject to serious wind or

water erosion hazards, with respect to which there are not adopted in 1938 methods recommended by the State committee and approved by the Agricultural Adjustment Administration for the prevention of wind or water erosion.

D. DEDUCTION FOR BREAKING OUT OF NATIVE SOD

$3.00 for each acre of native sod or any other land which has been cropped but is not classified as cropland or pasture land which, in areas designated by the Agricultural Adjustment Administration as being areas subject to serious wind erosion or areas containing large acreages unsuited to continuing production of cultivated crops, is broken out during the period November 1, 1937, to October 31, 1938, inclusive, unless the breaking out of such land is approved by the county committee as a good farming practice and an equal acreage of cropland on the same farm is restored to permanent vegetative cover, such acreage of cropland to be in addition to that designated as restoration land.

SECTION VI. DIVISION OF PAYMENTS AND DEDUCTIONS

A. PAYMENTS AND DEDUCTIONS IN CONNECTION WITH ACREAGE ALLOTMENTS AND RESTORATION LAND GOALS

The net payment or net deduction computed for any farm with respect to the corn, cotton, rice, wheat, tobacco, peanuts, or potato acreage allotment, or general soil-depleting crops shall be divided among the landlords, tenants, and sharecroppers in the same proportion (as indicated by their acreage shares expressed in terms of either proportionate acreages or percentages) that such persons are entitled, at the time the crop is harvested, to share in the proceeds (other than a fixed commodity payment) of the corn, cotton, rice, wheat, tobacco, peanuts, potatoes, or general crops, respectively, grown on the farm in 1938.

The net payment or net deduction computed with respect to the restoration land goal for any farm, which is owned by one person and operated by one person, shall be divided in the same proportion that any payment with respect to the wheat acreage allotment for such farm is divided among landlords, tenants, and sharecroppers, provided that if no payment is computed with respect to a wheat acreage allotment for such farm, the net payment or net deduction with respect to the restoration land goal shall be divided in the same proportion that any payment in connection with general soil-depleting crops for such farm is, or would be, divided among landlords, tenants, and sharecroppers. The net payment or net deduction computed with respect to the restoration land goal for any farm which comprises field-rented or separately owned tracts shall be divided among the landlords, tenants, and sharecroppers in the same proportion (as indicated by their acreage shares expressed in terms of either proportionate acreages or percentages) that such persons contribute to the restoration land on such farm. Each person shall be deemed to have contributed to the acreage of restoration land on a field-rented or separately owned tract in the proportion that the principal crop normally grown on such tract is divided. In the event that restoration land is designated for a farm which is not operated by a tenant in 1938, the net payment or net deduction, if any, with respect to such restoration land goal shall be attributed to the owner of such farm.

In computing such net payments and net deductions with respect to acreage allotments, general crops, and restoration land goals, the deduction with respect to commercial vegetables (item 5, subsection A, Section V) shall be regarded as a prorata deduction with respect to the potato acreage allotment and the cigar filler (type 41) or binder (types 51, 52, and 53) tobacco acreage allotment. The total amount of deductions computed under Section V with respect to (1) soil-depleting crops grown in excess of the total soil-depleting acreage allotment (item 6, subsection A); (2) failure to prevent wind and water erosion (subsection C); and (3) breaking out of native sod (subsection D) shall be regarded (a) as prorata deductions with respect to the payments computed under Section IV in connection with the wheat acreage allotment and general soil-depleting crops on class A farms, *Provided*, That if no such payments are computed for the farm the total amount of such deductions

shall be regarded as a net deduction with respect to general soil-depleting crops; (b) as deductions with respect to the wheat acreage allotment on class B farms for which a payment is computed under Section IV in connection with a wheat acreage allotment; (c) as prorata deductions with respect to the payments computed under Section IV in connection with crop acreage allotments and the restoration land goal on class B farms for which no payment is computed in connection with a wheat acreage allotment, or (d) as deductions with respect to the soil-building goal on class B farms for which no payment is computed under Section IV in connection with crop acreage allotments or a restoration land goal, provided, that any net amount of such deductions computed for such farms shall be divided equally among the landlords and tenants on the farm.

In the event that corn, cotton, rice, wheat, tobacco, peanuts, potatoes, or general crops are not harvested in 1938 on the farm, or in the event the county committee, in accordance with instructions issued by the Agricultural Adjustment Administration, finds that due to crop failure the acreage of such crop(s) was reduced sufficiently to affect materially the division of payments or deductions, the net payment or net deduction, if any, with respect to the acreage allotment for such crop(s) shall be divided among the landlords, tenants, and sharecroppers in the same proportion that the county committee determines that such persons would have shared in the proceeds of such crop(s) if such crop(s) had been harvested on the farm in 1938 or if the acreage of such crop(s) had not been so reduced.

B. PAYMENTS WITH RESPECT TO SOIL-BUILDING PRACTICES

The amount of payment earned in connection with the soil-building goal for the farm shall be paid to the landlord, tenant, or sharecropper who carried out the soil-building practices. If the county committee determines that more than one such person contributed to the carrying-out of soil-building practices on the farm in 1938, such payment shall be divided in the proportion that the units contributed by each such person to such practices bears to the total units of such practices carried out on the farm in 1938. Each person contributing to the practice carried out on a particular acreage shall be deemed to have contributed equally to the units of such practices unless such persons establish to the satisfaction of the county committee that their respective contributions thereto were not in equal proportion, in which event such unit shall be divided in the proportion which the county committee determines each such person contributed thereto.

C. PRORATION OF NET DEDUCTIONS

If with respect to any farm the sum of the net payments computed for all persons on the farm exceeds the sum of the net deductions computed for all persons on the farm, the net deduction computed for any person on the farm shall be prorated among the persons on the farm for whom a net payment is computed in the proportion in which the net payment computed for any person is of the sum of the net payments computed for all persons on the farm. If, with respect to any farm the sum of the net deductions computed for all persons on the farm equals or exceeds the sum of the net payments computed for all persons on the farm, no payment will be made with respect to such farm and the amount of such net deductions in excess of the net payments shall be prorated among the persons on the farm in the proportion which the net deduction computed for any person is of the sum of the net deductions computed for all persons on the farm.

SECTION VII. INCREASE IN SMALL PAYMENTS

The total payment computed under Sections IV to VI, inclusive, for any person with respect to any farm shall be increased as follows:

(1) Any payment amounting to 71 cents or less shall be increased to $1.00;

(2) Any payment amounting to more than 71 cents but less than $1.00 shall be increased by 40 percent;

(3) Any payment amounting to $1.00 or more shall be increased in accordance with the following schedule:

Amount of payment computed	Increase in payment	Amount of payment computed	Increase in payment
$1.00 to 1.99	$0.40	$32.00 to 32.99	$10.40
2.00 to 2.99	0.80	33.00 to 33.99	10.60
3.00 to 3.99	1.20	34.00 to 34.99	10.80
4.00 to 4.99	1.60	35.00 to 35.99	11.00
5.00 to 5.99	2.00	36.00 to 36.99	11.20
6.00 to 6.99	2.40	37.00 to 37.99	11.40
7.00 to 7.99	2.80	38.00 to 38.99	11.60
8.00 to 8.99	3.20	39.00 to 39.99	11.80
9.00 to 9.99	3.60	40.00 to 40.99	12.00
10.00 to 10.99	4.00	41.00 to 41.99	12.10
11.00 to 11.99	4.40	42.00 to 42.99	12.20
12.00 to 12.99	4.80	43.00 to 43.99	12.30
13.00 to 13.99	5.20	44.00 to 44.99	12.40
14.00 to 14.99	5.60	45.00 to 45.99	12.50
15.00 to 15.99	6.00	46.00 to 46.99	12.60
16.00 to 16.99	6.40	47.00 to 47.99	12.70
17.00 to 17.99	6.80	48.00 to 48.99	12.80
18.00 to 18.99	7.20	49.00 to 49.99	12.90
19.00 to 19.99	7.60	50.00 to 50.99	13.00
20.00 to 20.99	8.00	51.00 to 51.99	13.10
21.00 to 21.99	8.20	52.00 to 52.99	13.20
22.00 to 22.99	8.40	53.00 to 53.99	13.30
23.00 to 23.99	8.60	54.00 to 54.99	13.40
24.00 to 24.99	8.80	55.00 to 55.99	13.50
25.00 to 25.99	9.00	56.00 to 56.99	13.60
26.00 to 26.99	9.20	57.00 to 57.99	13.70
27.00 to 27.99	9.40	58.00 to 58.99	13.80
28.00 to 28.99	9.60	59.00 to 59.99	13.90
29.00 to 29.99	9.80	60.00 to 185.99	14.00
30.00 to 30.99	10.00	186.00 to 199.99	[1]
31.00 to 31.99	10.20	200.00 and over	[2]

[1] Increase to 200.00.

[2] No increase.

SECTION VIII. DEDUCTIONS INCURRED ON OTHER FARMS

A. OTHER FARMS IN THE SAME COUNTY

If the deductions computed under Section V with respect to any farm in a county exceed the payment for full performance on such farm computed under Section IV, a landlord's or tenant's share of the amount by which such deduction exceeds such payments shall be deducted from such landlord's or tenant's share of the payment which would otherwise be made to him with respect to any other farms in such county.

B. OTHER FARMS IN THE STATE

If the deductions computed for a landlord or tenant with respect to one or more farms in a county exceed the payments computed for such landlord or tenant on other farms in such county, the amount of such excess deductions shall be deducted from the payments computed for such landlord or tenant with respect to any other farms in the State if the State committee finds that the crops grown and practices adopted on the farm with respect to which such deductions are computed substantially offset the contribution to the program made on such other farms.

SECTION IX. DEDUCTION FOR ASSOCIATION EXPENSES

There shall be deducted pro rata from the payments with respect to any farm all or such part as the Secretary may prescribe of the estimated administrative expenses incurred or to be incurred by the county agricultural conservation association in the county in which the farm is located.

SECTION X. MATERIALS FURNISHED AS GRANTS OF AID

Wherever it is found practicable limestone, superphosphate, trees, seeds, and other materials, upon request of the producer, may be furnished by the Agricultural Adjustment Administration as grants of aid to be used in carrying out approved soil-building practices which shall be counted toward meeting the soil-building goal for the farm. Wherever such materials are furnished, a deduction from the payment for the farm shall be made in the amount of the approximate cost of such material to the Agricultural Adjustment Administration. Such deduction shall be applied first to the payment computed for the person to whom such materials are furnished, and the balance, if any, of such deduction shall be prorated among the payments to other persons sharing in the payment with respect to the farm on which such materials were used.

In making a request for materials pursuant to this section the producer to whom such materials are furnished shall agree that in the event the amount of the deduction for the material exceeds the amount of the payment with respect to the farm the amount of such difference shall be repaid by him to the Secretary.

SECTION XI. GENERAL PROVISIONS RELATING TO PAYMENTS

A. PAYMENT RESTRICTED TO EFFECTUATION OF PURPOSES OF THE PROGRAM

All or any part of any payment which otherwise would be made to any person under the 1938 Agricultural Conservation Program may be withheld (1) if he has adopted any practice which the Secretary determines tends to defeat any of the purposes of the 1938 or previous agricultural conservation programs, (2) if, by means of any corporation, partnership, estate, trust, or any other device, or in any manner whatsoever, he has offset, or has participated in offsetting, in whole or in part, the performance for which such payment is otherwise authorized, or (3) if, with respect to forest land or woodland owned or controlled by him, he adopts any practice which the regional director finds is contrary to sound conservation practices. If on any class B farm for which no wheat, cotton, corn, tobacco, peanut, potato, or rice acreage allotment is established, the acreage of soil-depleting crops in 1938 is in excess of 50 acres and in excess of the total soil-depleting acreage allotment, the deduction provided in paragraph 6 (c) of subsection A of Section V shall be applicable to such farm if the county committee determines that the increase in soil-depleting crops was not due to the rotation of crops normally followed on the farm. No payment, other than a payment in connection with the restoration land goal, shall be computed with respect to any farm which is idle in 1938.

In areas designated by the Agricultural Adjustment Administration as areas subject to serious wind erosion in 1938, no payment will be made to any person with respect to any farm which such person owns or operates in a county if he allows any part of the cultivated acreage in any such farm to become a wind erosion hazard during 1938 by reason of failure to carry out wind erosion control measures approved by the county committee.

B. PAYMENT COMPUTED AND MADE WITHOUT REGARD TO CLAIMS

Any payment or share of payment shall be computed and made without regard to questions of title under State law, without deduction of claims for advances (except as provided in subsection D of this Section XI) and without regard to any claim or lien against any crop, or proceeds thereof, in favor of the owner or any other creditor.

C. CHANGES IN LEASING AND CROPPING AGREEMENTS, REDUCTION IN NUMBER OF TENANTS, AND OTHER DEVICES

If on any farm in 1938 any change of the arrangements which existed on the farm in 1937 is made between the landlord and the tenants or sharecroppers and such change would cause a greater proportion of the payments to be made to the landlord under the 1938 Agricultural Conservation Program than would have been made to the landlord for performance on the farm under the 1937 Agricultural Conservation Program, payments to the landlord under the 1938 Agricultural Conservation Program with respect to the farm shall not be greater than the amount that would have been paid to the landlord if the arrangements which existed on the farm in 1937 had been continued in 1938, if the county committee certifies that the change is not justified and disapproves such change.

If on any farm the number of sharecroppers or share tenants in 1938 is less than the average number on the farm during the years 1935 to 1937, inclusive, and such reduction would increase the payments that would otherwise be made to the landlord, such payments to the landlord shall not be greater than the amount that would otherwise be made if the county committee certifies that the reduction is not justified and disapproves such reduction.

If the State committee finds that any person who files an application for payment pursuant to the provisions of the 1938 Agricultural Conservation Program has employed any other scheme or device, the effect of which would be or has been to deprive any other person of any payment under any agricultural conservation program to which such other person would normally be entitled, the Secretary may withhold in whole or in part from the person participating in or employing such a scheme or device, or require such person to refund in whole or in part the amount of any payment which has been or would otherwise be made to such person in connection with the 1938 Agricultural Conservation Program.

D. ASSIGNMENTS

Any person who may be entitled to any payment in connection with the 1938 Agricultural Conservation Program may assign his interest in such payment as security for cash loaned or advances made for the purpose of financing the making of a crop in 1938. No such assignment will be recognized unless (1) the assignment is made in writing on Form ACP–69 in accordance with instructions issued by the Agricultural Adjustment Administration, and is filed in the office of the county agricultural conservation association; (2) the farmer files with the assignment a statement that the assignment is made to pay or secure an indebtedness incurred in connection with financing the making of a crop in 1938 and not to pay or secure any preexisting indebtedness; and (3) the person to whom such assignment is made certifies that the payment is being assigned without discount for such purpose.

Nothing contained in this Section XI shall be construed to give an assignee a right to any payment other than that to which the farmer is entitled nor shall the Secretary or any disbursing agent be subject to any suit or liability if payment is made to the farmer without regard to the existence of any such assignment.

E. EXCESS COTTON ACREAGE

Any person who makes application for payment with respect to any farm located in a county in which cotton is planted in 1938 shall file with such application a statement that the applicant has not knowingly planted or caused to be planted during 1938 cotton on land in any farm in which he has an interest in excess of the cotton acreage allotment established for the farm for 1938, and that cotton was not planted in excess of such allotment by his authority or with his consent.

Any person who knowingly plants cotton on his farm in 1938 on acreage in excess of the cotton acreage allotment established for the farm for 1938 shall not be eligible for any payment under the provisions of the 1938 Agricultural Conservation Program. Any person having an interest in the cotton crop on a farm on which cotton is planted in 1938 on acreage in excess of the cotton acreage allotment for the farm for 1938 shall be presumed to have knowingly planted cotton on his farm on acreage in excess of such farm cotton acreage allotment if notice of the farm allotment is mailed to him prior to the completion of the planting (seeding) of cotton on the farm, unless the farmer establishes the fact that the excess acreage planted to cotton was due to his lack of knowledge of the number of acres in the tract(s) planted to cotton. Such notice, if mailed to the operator of the farm, shall be deemed to be notice to all persons sharing in the production of cotton on the farm in 1938.

F. USE OF SOIL-CONSERVING CROPS FOR MARKET

No payment will be made with respect to any farm unless on such farm in 1938 an acreage of cropland or restoration land, not devoted to soil-depleting crops, is withheld from the production of soil-conserving crops for market, equal to the acreage by which the normal acreage of soil-depleting crops on such farm exceeds the larger of (1) the total soil-depleting acreage allotment for the farm or (2) the acreage devoted to soil-depleting crops on the farm in 1938: *Provided*,

That payment shall not be denied any farmer for using such soil-conserving crops for market (1) if in the county in which the farm is located the number of cows kept for the production of milk or products thereof for market does not exceed the normal number of such cows; (2) if on such farm the number of cows kept for the production of milk or the products thereof for market does not exceed the normal number of such cows; or (3) if the Agricultural Adjustment Administration determines either (a) that the farmer has substantially complied with the provisions of this paragraph, or (b) that the county, as a whole, is in substantial compliance with such provisions.

Any farmer shall be deemed to have substantially complied with the provisions of the foregoing paragraph either (1) if the increase above normal in the number of dairy cows on his farm does not exceed two cows; or (2) if none of the soil-conserving crops to which such provisions are applicable are used for market other than through the disposition of dairy livestock for slaughter or through the disposition of less than ten percent of the milk, or products thereof, produced on the farm. A county, as a whole, shall be deemed to be in substantial compliance with such provisions unless: (1) The number of cows kept for the production of milk in the county exceeds by more than five percent the normal number of such cows; (2) the acres retired from soil-depleting crops in the county exceed five percent of the normal acreage of such crops and exceed 1,000 acres; and (3) the average number of cows kept for the production of milk exceeds two cows per farm and exceeds two cows per 160 acres of farm land.

The normal acreage of soil-depleting crops and the number of cows kept for the production of milk or the products thereof for market shall be determined for any farm in accordance with instructions issued by the Agricultural Adjustment Administration, and the Agricultural Adjustment Administration shall determine from the latest available statistics of the Department, and shall announce, the counties not deemed to be in substantial compliance.

As used in this subsection F, the term "for market" means for disposition by sale, barter, or exchange, or by feeding (in any form) to dairy livestock which, or the products of which, are to be sold, bartered, or exchanged, and such term shall not include consumption on the farm. An agricultural commodity shall be deemed to be consumed on the farm if consumed by the farmer's family, employees, or household, or if fed to poultry or livestock other than dairy livestock on his farm, or if fed to dairy livestock on his farm and such dairy livestock, or the products thereof, are to be consumed by his family, employees, or household. As used in this subsection F, the term "soil-conserving crops" means grasses and legumes grown on cropland except those classified as soil-depleting under Section XIII thereof.

SECTION XII. APPLICATION FOR PAYMENT

A. PERSONS ELIGIBLE TO FILE APPLICATIONS

An application for payment with respect to a farm may be made by any person for whom, under the provisions of Section VI a share in the payment with respect to the farm may be computed and (1) who at the time of harvest is entitled to share in the crops grown on the farm under a lease or operating agreement, or (2) who is owner or operator of such farm and participates thereon in 1938 in carrying out approved soil-building practices or in carrying out conservation measures designed to promote restoration of a permanent vegetative cover on restoration land.

B. TIME AND MANNER OF FILING APPLICATION AND INFORMATION REQUIRED

Payment will be made only upon application submitted through the county office. The Secretary reserves the right (1) to withhold payment from any person who fails to file any form or furnish any information required with respect to any farm which such person is operating or renting to another person for a share of the crops grown thereon, and (2) to refuse to accept any application for payment if such application or any other form or information required is not submitted to the county office within the time fixed by the regional director. At least two weeks' notice to the public shall be given of the expiration of a time limit for filing prescribed forms. Such notice shall be given by mailing the same to the office of each county committee and making copies of the same available to the press.

C. APPLICATIONS FOR OTHER FARMS

If a person has the right to receive all or a portion of the crops or proceeds therefrom, produced on more than one farm in a county and makes application for payment with respect to one of such farms, such person must make application for payment with respect to all such farms which he operates or rents to other persons. Upon request by the State committee such person shall also file with the committee such information as it may request regarding any other farm in the State with respect to which he has the right to receive all or a portion of the crops or proceeds thereof.

SECTION XIII. SOIL-DEPLETING CROPS

Land devoted in 1938 to any of the following crops or uses or such other similar crops and uses as are designated by the Agricultural Adjustment Administration shall be classified as soil-depleting:

A. Land planted to the following crops for harvest in 1938:

1. Corn (including field corn, sweet corn, and popcorn, but excluding sown or close-drilled corn used as a cover crop or green manure crop).
2. Tobacco (except that Georgia-Florida Type 62 tobacco shall be classified as provided in the 1938 Agricultural Conservation Program Bulletin, Supplement No. 2).
3. Grain sorghums (except when a good stand and a good growth of such crops is used as a green manure crop in areas in Texas designated by the Agricultural Adjustment Administration as areas affected by cotton root rot).
4. Cotton (except when such crop fails to reach the stage at which bolls are first formed).
5. Sugar beets.
6. Sugarcane.
7. Rice.
8. Peanuts harvested for nuts.
9. Commercial mustard.
10. Hemp.
11. Broomcorn.
12. Mint.
13. Mangels and cowbeets.
14. Cultivated sunflowers.
15. Truck and vegetable crops (including strawberries, melons and sweet potatoes) and their seeds.
16. Potatoes.
17. Bulbs and flowers.
18. Safflower.
19. Field beans.
20. Canning peas.

B. Land planted to wheat harvested for grain or hay in 1938 or any other land planted to wheat between August 1, 1937 and July 31, 1938, except

1. When, in the North Central Region, the acreage of such crop seeded in the fall of 1937 is pastured before May 1, 1938 and thereafter sufficiently pastured or tilled to prevent grain formation, or is tilled before May 1, 1938 in preparation for another crop or for a use other than the harvesting of the acreage of such crop for grain or hay; or

2. When, in humid areas other than in the North Central Region designated by the Agricultural Adjustment Administration, the acreage of such crop is used as a nurse crop or cover crop and is not harvested for grain or hay; or

3. When in designated non-humid areas of Texas, Oklahoma, Kansas, Colorado, and New Mexico, the acreage of such crop seeded in the fall of 1937 is tilled before a date to be specified by the Agricultural Adjustment Administration, in preparation for another crop or in connection with an approved conservation measure; *Provided*, That in such areas the conservation measure to be instituted before the specified date shall be approved by the county committee and the land to be so handled shall be designated in accordance with instructions issued by the Agricultural Adjustment Administration; or

4. When the acreage is seeded to true type winter wheat in the spring of 1938 (prior to June 15) on non-irrigated cropland and such crop is used only as a pasture or cover crop (applicable only in Washington, Oregon, Idaho, and Utah) ; or

5. When the acreage of such crop is used as a green manure crop in orchards or on commercial vegetable or potato land or such other land as may be designated by the Agricultural Adjustment Administration.

C. Land planted to oats (except when used in Washington and Oregon as a support crop for vetch or Austrian field peas harvested for seed), barley, rye, flax, emmer, speltz, or mixtures of these crops between August 1, 1937 and July 31, 1938, except

1. When a good stand and good growth of such crop is used as a green manure crop in orchards, or on commercial vegetable or potato land, or such other land as may be designated by the Agricultural Adjustment Administration; or

2. When such crop is used as a nurse crop or cover crop and is not harvested for grain or hay and not used in any area in any other manner determined by the Agricultural Adjustment Administration to be soil-depleting in such area.

D. Land planted in 1938 to buckwheat, sweet sorghums, Sudan grass, millet, or sown or close-drilled corn harvested for grain, seed, sirup, or silage, or used in any areas in any other manner determined by the Agricultural Adjustment Administration to be soil-depleting in such area.

E. Land planted in 1938 to field peas harvested for peas or soybeans harvested for seed for crushing, or used in any area in any other manner determined by the Agricultural Adjustment Administration to be soil-depleting in such area.

F. Land summer fallowed in the States of Washington, Oregon, Idaho, and Utah; provided, however, that if such summer-fallowed acreage is seeded in 1938 to perennial grasses or perennial legumes in accordance with good farming practice such acreage shall not be classified as soil-depleting.

G. Land summer fallowed in any area if such summer-fallowed acreage is not protected from wind and water erosion by methods recommended by the State committee and approved by the Agricultural Adjustment Administration.

The acreage of land which is devoted consecutively to two or more of the above soil-depleting crops in 1938 shall be counted as follows: If only one of such crops reaches maturity such land shall be regarded as devoted to the crop reaching maturity. If none of such crops reaches maturity or if more than one of such crops reach maturity and an individual crop acreage allotment is established for only one of such crops, such land shall be regarded as devoted to the crop for which an individual crop acreage allotment is established. If none of such crops reaches maturity and individual crop acreage allotments are established for two or more of such crops, the land shall be regarded as devoted to the last planted of such crops for which an individual crop acreage allotment is established. If two or more of such crops reach maturity and individual crop acreage allotments are established for two or more of such crops reaching maturity, the land shall be regarded as devoted to each of the crops which reached maturity and for which an individual crop acreage allotment is established. If two or more of such crops reach maturity or if none of such crops reaches maturity and individual crop acreage allotments are not established for any of such crops the land shall be regarded as devoted to the last planted of such crops.

The acreage of land which is devoted simultaneously to two or more of the above soil-depleting crops shall be divided among such crops on the basis of the land determined, in accordance with instructions issued by the Agricultural Adjustment Administration, to be devoted to each.

In connection with determinations regarding the maturity of crops, canning peas will be deemed to have reached maturity when such crops are harvested for canning and field corn, sweet corn, and popcorn hogged off or cut for silage, fodder or other similar uses, will be deemed to have reached maturity.

If a corn acreage allotment is established for any farm, all acreages of field corn, sweet corn, and popcorn will be regarded as corn acreage for the purpose of determining whether the corn acreage allotment for such farm has been exceeded, except (1) any acreage of sweet corn contracted to be sold for canning; (2) any acreage of sweet corn sold for canning or roasting ears; (3)

any acreage of sweet corn to be sold or used as seed; and (4) any acreage of popcorn sold as popcorn or to be sold or used as seed.

In areas designated by the Agricultural Adjustment Administration as areas where cropland is commonly divided into regularly-shaped fields, in order for a portion of a field (other than cropland strip-cropped, strip-fallowed or contour farmed) not to be classified as soil-depleting such portion of the field must be in a solid block contiguous to the side or end of the field and the line between such portion and the remaining portion of the field must be straight.

Land devoted to volunteer crops harvested shall be classified as if such crops were planted.

SECTION XIV. SOIL-BUILDING PRACTICES

Such of the soil-building practices listed in the following schedule as the Agricultural Adjustment Administration determines are adapted to any region and should be encouraged in such region shall count toward the achievement of the soil-building goal to the extent indicated therein, when such practices are carried out in 1938 in areas designated by the Agricultural Adjustment Administration and in accordance with specifications issued by the regional director or by the State committee with the approval of the regional director. The areas designated for any soil-building practice shall be areas in which such practice is desirable and necessary as a conservation measure. The specifications issued shall be such as to assure that the soil-building practice will be performed in workmanlike manner and in accordance with good farming practice for the locality.

Practices carried out with labor, seed, trees, and materials furnished entirely by any Federal or State agency other than the Agricultural Adjustment Administration shall not be counted toward the achievement of the soil-building goal. If a portion of the labor, seed, trees, or other materials used in carrying out any practice is furnished by a State or Federal agency other than the Agricultural Adjustment Administration and such portion represents one-half or more of the total cost of carrying out such practice, such practice shall not be counted toward the achievement of the soil-building goal; if such portion represents less than half of the total cost of carrying out such practice, one-half of such practice shall be counted toward the achievement of the soil-building goal.

If trees are purchased from a Clark-McNary Cooperative State Nursery, such purchases shall not be deemed to be paid for in whole or in part by a State or Federal agency.

Schedule of Soil-Building Practices

A. Each of the following practices in the amounts specified shall be counted as one unit; *Provided*, That when the materials specified in items 1, 2, or 3 are applied to biennial or perennial legumes, perennial grasses, winter legumes, lespedeza, crotalaria, or Natal grass seeded or grown in connection with a soil-depleting crop, only such proportionate part, if any, of the material applied shall be counted as is specified by the Agricultural Adjustment Administration.

1. Application of 300 pounds of 16-percent superphosphate (or its equivalent) to, or in connection with the seeding of, perennial or biennial legumes, perennial grasses, winter legumes, lespedeza, crotalaria, Natal grass, or permanent pasture.
2. Application of 200 pounds of 50-percent muriate of potash (or its equivalent) to, or in connection with the seeding of, perennial or biennial legumes, perennial grasses, winter legumes, lespedeza, crotalaria, Natal grass, or permanent pasture.
3. Application of 500 pounds of basic slag or rock phosphate to, or in connection with the seeding of, perennial or biennial legumes, perennial grasses, winter legumes, lespedeza, crotalaria, Natal grass, or permanent pasture.
4. Application of 300 pounds of gypsum containing 18-percent sulphur (or its sulphur equivalent).
5. Construction of 200 linear feet of standard terrace for which proper outlets are provided.
6. Construction of reservoirs and dams—15 cubic yards of material moved in making the fill or excavation.

7. Reseeding depleted pastures with good seed of adapted pasture grasses or legumes—10 pounds of seed.

8. Contour ridging of non crop open pasture land—750 linear feet of ridge or terrace.

9. Application of one ton, air dry weight, of straw or equivalent mulching material, excluding barnyard and stable manure, in commercial orchards or on commercial vegetable land in areas designated by the regional director as areas in which straw normally costs more than $5.00 per short ton.

10. Application of not less than two tons, air dry weight, of straw or equivalent mulching materials, excluding barnyard and stable manure, per acre in commercial orchards or on commercial vegetable land.

11. Application of the following quantities of ground limestone or its equivalent in areas designated by the regional director as areas in which the average cost of ground limestone to farmers is:

(a) Not more than $2.50 per ton	2,000 lb.
(b) More than $2.50 but not more than $3.50 per ton	1,500 lb.
(c) More than $3.50 but not more than $5.00 per ton	1,000 lb.
(d) More than $5.00 per ton	800 lb.

12. Application of 1,000 pounds of finely ground limestone (at least 90 percent to pass through a 30-mesh sieve and all finer particles obtained in the grinding process to be included), except to peanuts and commercial vegetables, such limestone to be applied at the rate of not less than 500 pounds nor more than 1,000 pounds per acre.

13. Restoration of noncrop open pasture by nongrazing during the normal pasture season on an acreage equal to one-half of the number of acres of such pasture required to carry one animal unit for a 12-month period.

B. Each acre of the following shall be counted as one unit:

1. Seeding biennial legumes, perennial legumes, perennial grasses (other than timothy or redtop) or mixtures (other than a mixture consisting solely of timothy and redtop) containing perennial grasses, perennial legumes, or biennial legumes (except alfalfa and permanent pasture mixtures qualifying under practice No. 1 of subsection C of this Section XIV).

2. Seeding winter legumes, annual lespedeza, annual ryegrass, crotalaria, sesbania, or annual sweet clover.

3. Green manure crops and cover crops (excluding (1) lespedeza, (2) any crop for which credit is given in 1938 under any other practice, (3) wheat on nonirrigated land except in humid areas designated by the Agricultural Adjustment Administration, and (4) such other crops as may be determined as not qualifiable for any area by the Agricultural Adjustment Administration) of which a good stand and good growth is (1) plowed or disced under on land not subject to erosion, or if subject to erosion, such crop is followed by a winter cover crop, or (2) left on land subject to erosion or in orchards or on commercial vegetable or potato land, or on such other land as is designated by the Agricultural Adjustment Administration.

C. Each acre of the following shall be counted as two units:

1. Seeding hardy northern-grown domestic or Canadian alfalfa (applicable only in the Northeast Region).

2. Seeding permanent pasture mixtures containing a full seeding of legumes or grasses, or both, other than timothy and redtop (applicable only in the Northeast Region and on class B farms in the Southern Region).

3. Cultivating, protecting, and maintaining by replanting, if necessary, a good stand of forest trees, planted between January 1, 1934 and January 1, 1938.

4. With prior approval of the county committee improving a stand of forest trees under such approved system of farm woodlot management as is specified by the Agricultural Adjustment Administration.

5. Establishment of permanent vegetative cover by planting sod pieces of perennial grasses.

6. Green manure crops of which a good stand and a good growth is plowed or disced under (applicable only to class B farms in the Western,

East Central and Southern Regions on which the average acreage of land on which commercial vegetables were grown in 1936 and 1937 exceeds 50 percent of the acreage of cropland in the farm in excess of the sum of the potato, tobacco, cotton, and peanut acreage allotments established for the farm).

D. Each acre of the following shall be counted as five units:

1. Planting forest trees (including shrubs in protective plantings) provided such trees are protected and cultivated in accordance with good tree culture practice.

2 Control of seriously infested plots of perennial noxious weeds, designated by the Agricultural Adjustment Administration, on cropland in organized weed control districts, in accordance with good chemical or tillage methods.

3. Applying sand free from stones or loam to a depth of at least one-half inch on fruiting cranberry bogs.

E. Each two acres of the following shall be counted as one unit:

1. Summer legumes not classified as soil-depleting (interplanted or grown in combination with soil-depleting crops) of which a good stand and a good growth is left on the land or plowed or disced under.

2. Renovation of perennial legumes and mixtures of perennial grasses and legumes.

3. Seeding timothy or redtop or a mixture consisting solely of timothy and redtop.

4. Protecting muck land subject to serious wind erosion by establishing or maintaining approved shrub windbreaks.

F. Each four acres of the following shall be counted as one unit:

1. Leaving on the land as a protection against wind erosion (only in wind erosion areas, which will be designated by the regional director) the stalks of sorghums or Sudan grass, classified as soil-depleting, where it is determined by the county committee that such cover is necessary as a protection against wind erosion and the operator's farming plan provides that such cover will be left on the land until the spring of 1939.

2. Restoration of farm woodlots, normally overgrazed, by non-grazing during the normal pasture season. Credit will not be allowed for more than two acres of woodland for each animal unit normally grazed on such woodland.

3. Contour listing or furrowing noncrop land.

4. Stripcropping other than for protection of summer-fallowed acreage.

5. Protecting summer-fallowed acreage from wind and water erosion by contour or basin listing, strip-cropping, or incorporating small-grain stubble and straw into the surface soil. No credit will be given for this practice on any farm when carried out on light sandy soils or on soils in any area where destruction of the vegetative cover has resulted in the land becoming subject to serious wind erosion.

G. Each six acres of the following shall be counted as one unit:

1. Controlling soil erosion by contour cultivation of intertilled crops (applicable only in the Northeast Region).

H. Each eight acres of the following shall be counted as one unit:

1. Contour farming intertilled crops.

2. Contour listing or basin listing on the contour. No credit will be given for this practice when carried out on protected summer-fallowed acreage or as a part of the seeding operation.

I. Each ten acres of the following shall be counted as one unit:

1. Contour seeding of small-grain crops.

2. Basin listing (not on the contour). No credit will be given for this practice when carried out on protected summer-fallowed acreage or as a part of the seeding operation.

3. Natural vegetative cover or small-grain stubble of crops harvested in 1938 left on cropland not tilled after July 1, 1938 where it is determined by the county committee that such cover is necessary as a protection against wind erosion and the operator's farming plan provides that such cover will be left on the land until the spring of 1939 (applicable only in wind erosion areas in Texas, Oklahoma, Kansas, Colorado, and New Mexico, such areas to be designated by the Agricultural Adjustment Administration).

SECTION XV. NORMAL YIELDS AND PRODUCTIVITY INDEXES

A. NORMAL YIELDS OF SPECIAL SOIL-DEPLETING CROPS

The county committee with the assistance of other local committees in the county shall determine for each farm for which a cotton, corn, wheat, rice, tobacco, peanut or potato acreage allotment is to be established a normal yield for each such crop in accordance with the provisions of this section and instructions issued by the Agricultural Adjustment Administration.

1. **Cotton.**—(a) Where reliable records of the actual average yield of cotton per acre for the years 1933 to 1937, inclusive, are presented by the farmer or are available to the committee, the normal yield for the farm shall be the average of such yields adjusted for abnormal weather conditions in accordance with instructions issued by the Agricultural Adjustment Administration.

(b) If for any year of such five-year period records of the actual average yield are not available or there was no actual yield because cotton was not planted on the farm in such year, the normal yield for the farm shall be the yield which, on the basis of all available facts, including the yield customarily secured on the farm, weather conditions, type of soil, drainage, production practices, and general fertility of the land, the county committee determines to be the yield which was or could reasonably have been expected on the farm for such five-year period.

(c) The yields determined under paragraph (b) of this subdivision 1 shall be adjusted so that the average of the normal yields determined for all farms in the county or administrative area (weighted by the cotton acreage allotments established for such farms) shall conform to the county (or administrative area) average yield established by the Secretary.

2. **Corn and wheat.**—(a) Where reliable records of the actual average yield per acre of corn or wheat, as the case may be, for the years 1928 to 1937, inclusive, are presented by the farmer or are available to the committee, the normal yield for the farm shall be the average of such yields adjusted for trends and abnormal weather conditions in accordance with instructions issued by the Agricultural Adjustment Administration.

(b) If for any year of such 10-year period reliable records of the actual average yield are not available or there was no actual yield because the commodity was not planted on the farm in such year, the normal yield for the farm shall be the yield which, on the basis of all the available facts, including the yield customarily secured on the farm, weather conditions, type of soil, drainage, production practices, and general fertility of the land, the county committee determines to be the yield which was or could reasonably have been expected on the farm for such 10-year period. Where the productivity index most recently established for the farm in connection with the agricultural conservation programs is determined by the county committee to be an accurate reflection of the foregoing factors, the yield obtained by multiplying such index by the county average yield established by the Secretary shall be used as the normal yield for the farm.

(c) The yields determined under paragraph (b) of this subdivision 2 shall be adjusted so that the average of the normal yields for all farms in the county (weighted respectively by the corn or wheat acreage allotments established for such farms) shall conform to the county average yield established by the Secretary.

(d) Where normal wheat yields are used for the purpose of computing deductions for farms in the States of Washington, Oregon, Idaho, and Utah (where land summer fallowed is classified as soil-depleting) such yields shall be reduced for such purpose in accordance with instructions issued by the Agricultural Adjustment Administration, to reflect the average production of wheat on the acreage normally devoted to wheat and summer fallow on the farm.

3. **Rice.**—(a) Where reliable records of the actual average yield of rice per acre for the years 1933 to 1937, inclusive, are presented by the farmer or are available to the committee, the normal yield of rice for the farm shall be the average of such yields.

(b) If for any year of such 5-year period records of the actual average yield are not available or there was no actual yield because rice was not planted on the farm in such year, the county committee shall ascertain from all the available facts, including the yield customarily secured on the farm, weather conditions, type of soil, drainage, production practices, and general

fertility of the land, the yield which was or could reasonably have been expected on the farm for such year, and the yield so determined shall be used as the actual yield for such year under paragraph (a) of this subdivision 3.

(c) If the average of the normal yields for all lands planted to rice in 1938 in the State (weighted by the rice acreage allotments therein) exceeds the average yield per acre for the State during the period 1933 to 1937, inclusive, established by the Secretary, the normal yields for such lands, determined under paragraphs (a) and (b) of this subdivision 3, shall be reduced pro rata so that the average of such normal yields shall not exceed such State average yield.

4. **Tobacco, peanuts, potatoes.**—(a) The normal yield of tobacco, peanuts for market, or potatoes, as the case may be, for any farms shall be the yield which may reasonably be expected from the land devoted to the production of the crop in 1938 with due consideration for type of soil, drainage, production practices, general fertility of the land and the yield of such crop customarily secured on the farm. The average yield for all farms in any county with respect to any such crop shall not exceed the county average yield for the crop established by the Secretary.

B. PRODUCTIVITY INDEXES

The Secretary shall establish for each county a county productivity index or per-acre rate which will vary among the counties as the productivity of the cropland in the county devoted to the production of general soil-depleting crops varies as compared with the productivity of cropland in the United States devoted to the production of such crops.

A productivity index or rate per acre shall be established in accordance with instructions issued by the Agricultural Adjustment Administration for each class A farm by the county committee, subject to the approval of the State committee. Such productivity index or rate per acre shall be based upon the normal yield per acre for the farm of the major soil-depleting crop in the county as compared with the normal yield per acre for such crop in the county. Where the yield of the major soil-depleting crop in the county does not accurately reflect the productivity of a farm, the yield of a crop that reflects the productivity of the farm may be used, provided that the productivity index or rate per acre for such farm shall be adjusted, if necessary, so as to be fair and equitable as compared with the productivity indexes or rates per acre for other farms in the county having similar soils or productive capacity, and as contrasted with other farms in the county having different soils or productive capacity.

The average productivity index or per-acre rate for all farms in the county shall not exceed 100 or the county per-acre rate, respectively, unless it is determined that farms for which such indexes or rates per acre are established are not representative of all farms in the county and a variation from 100 or the county per-acre rate is approved by the Agricultural Adjustment Administration.

SECTION XVI. APPEALS

Any person who considers himself aggrieved by any recommendation or determination of the county committee with respect to any farm in which he has an interest may, within 15 days after notice thereof is forwarded to or available to him request the county committee in writing to reconsider its recommendation or determination with respect to any of the following matters: (a) Eligibility to file an application for payment; (b) any soil-depleting acreage allotment or soil-building goal; (c) the division of payment; or (d) any other matter affecting the right to or the amount of his payment with respect to the farm. The county committee shall notify such person of its decision in writing within 15 days after receipt of such written request for reconsideration. If such person is dissatisfied with the decision of the county committee he may, within 15 days after such decision is forwarded to or made available to him, appeal in writing to the State committee. The State committee shall notify such person of its decision in writing within 30 days after the receipt of the appeal. If such person is dissatisfied with the decision of the State committee, he may, within 15 days after such decision is forwarded to or made available to him, request the regional director to review the decision of the State committee.

SECTION XVII. STATE AND REGIONAL BULLETINS, INSTRUCTIONS, AND FORMS

The Agricultural Adjustment Administration shall prepare and issue such State and regional bulletins, instructions, and forms as may be required in administering the 1938 Agricultural Conservation Program.

SECTION XVIII. DEFINITIONS

For the purposes of the 1938 Agricultural Conservation Program

Secretary means the Secretary of Agriculture of the United States.

Regional director means the director of the division of the Agricultural Adjustment Administration in charge of the 1938 Agricultural Conservation Program in the region.

Northeast Region means the area included in the States of Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

East Central Region means the area included in the States of Delaware, Kentucky, Maryland, North Carolina, Tennessee, Virginia, and West Virginia.

Southern Region means the area included in the States of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, South Carolina, and Texas.

North Central Region means the area included in the States of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin.

Western Region means the area included in the States of Arizona, California, Colorado, Idaho, Kansas, Montana, Nevada, New Mexico, North Dakota, Oregon, Utah, Washington, and Wyoming.

State committee means the group of persons designated within any State to assist in the administration of the 1938 Agricultural Conservation Program in such State.

County committee means the group of persons elected within any county to assist in the administration of the 1938 Agricultural Conservation Program in such county.

County means the political or civil division of a State designated as a county or in the State of Louisiana as a parish, except that for the purposes of the 1938 Agricultural Conservation Program groups of townships in the political or civil divisions of Polk, Ottertail, and St. Louis in Minnesota, and Pottawattamie in Iowa may be designated as counties.

Person means an individual, partnership, association, corporation, estate, or trust, and, wherever applicable, a State, a political subdivision of a State, or any agency thereof.

Landlord means a person who owns land and rents such land to another person or operates such land.

Sharecropper means a person who works a farm in whole or in part under the general supervision of the operation and is entitled to receive for his labor a share of a crop produced thereon or the proceeds thereof.

Tenant means a person other than a sharecropper who rents land from another person (for cash, a fixed commodity payment, or a share of the proceeds of the crops) and is entitled under a written or oral lease or agreement to receive all or a share of the proceeds of the crops produced thereon, and, in the case of rice, also means a person furnishing water for a share of the rice.

Farm means all adjacent or nearby farm land under the same ownership which is operated by one person, including also:

1. Any other adjacent or nearby farm land operated by the same person (as part of the same unit with respect to the rotation of crops and with workstock, farm machinery, and labor substantially separate from that for any other land), the inclusion of which is requested or agreed to, within the time and in the manner specified by the Agricultural Adjustment Administration, by the operator and all the owners who are entitled to share in the proceeds of the crops on any of the land to be included in the farm, which request and agreement shall be applicable to the designation of the land included in such farm both under the 1938 Agricultural Conservation Program and under the provisions of the Agricultural Adjustment Act of 1938; and

2. Any field-rented tract (whether operated by the same or another person) which, together with any other land included in the farm, constitutes a unit with respect to the rotation of crops;

Provided, That land not under the same ownership shall be included in the same farm only if the county committee determines that all of such land is customarily regarded in the community as constituting one farm. A farm shall be regarded as located in the county or administrative area, as the case may be, in which the principal dwelling is situated, or if there is no dwelling thereon, it shall be regarded as located in the county or administrative area, as the case may be, in which the major portion of the farm is located.

All adjacent or nearby farm land under the same ownership which is operated by one person may be considered a farm even though such land is located in more than one State if the Regional Director finds that such land is, in fact, operated as a unit with respect to the rotation of crops.

Class A farms include:

(1) All farms in the North Central Region.

(2) All farms in Kansas, North Dakota, and Oklahoma.

(3) All farms in Texas except in Reeves and El Paso Counties.

(4) All farm in the following counties in Montana, Wyoming, Colorado, New Mexico, California, and Arkansas:

MONTANA: Glacier, Pondera, Teton, Lewis and Clark, Broadwater, Gallatin, and all counties east thereof.

WYOMING: Campbell, Converse, Crook, Goshen, Johnson, Laramie, Niobrara, Platte, Sheridan, and Weston.

COLORADO: Larimer, Boulder, Jefferson, Teller, El Paso, Pueblo, Huerfano, Las Animas, and all counties east thereof.

NEW MEXICO: Union, Harding, Quay, Curry, Roosevelt, De Baca, Torrance, Lincoln, Lea, and Otero.

CALIFORNIA: Butte, Colusa, Fresno, Glenn, Kern, Kings, Madera, Merced, San Benito, Monterey, Sacramento, San Joaquin, San Luis Obispo, Santa Barbara, Solano, Stanislaus, Sutter, Tehama, Tulare, Ventura, Yolo, Yuba, and that portion of Placer County lying west of the east boundary of Range 6 East, Mt. Diablo Meridian.

ARKANSAS: Arkansas, Baxter, Benton, Boone, Carroll, Clay, Crawford, Franklin, Fulton, Independence, Johnson, Logan, Madison, Marion, Newton, Perry, Prairie (except Area II), Randolph (except Area I), Saline, Scott, Searcy, Sebastian (except Area I), Sharp, Stone, Van Buren, Washington, and Yell.

(5) All farms in Aroostook County, Maine, and in the townships of Patten, Mt. Chase, and Stacyville in Penobscot County, Maine, for which potato acreage allotments are established; and

(6) All farms in the Northeast Region on which the average acreage of commercial vegetables grown on the farm in 1936 and 1937 exceeds 50 percent of the acreage of cropland in excess of the sum of the average acreages of potatoes and tobacco grown on the farm in 1936 and 1937.

Class B farms means all farms which are not class A farms.

Cropland means farm land which is tilled annually or in a regular rotation, excluding commercial orchards, restoration land, and any land which constitutes, or will constitute if such tillage is continued, a wind erosion hazard to the community, but including any other land which has been planted since January 1, 1930 to permanent pasture or forest trees and which was classified as cropland under the 1937 Agricultural Conservation Program, and including also land planted to noncommercial orchards other than abandoned orchards.

Restoration land means farm land, in areas designated by the Agricultural Adjustment Administration as areas subject to serious wind erosion and areas containing large acreages unsuited to continued production of cultivated crops, which has been cropped at least once since January 1, 1930, and which is designated by the county committee as land on which, because of its physical condition and texture and because of climatic conditions, a permanent vegetative cover should be restored.

Commercial orchards means the acreage in planted or cultivated fruit trees, nut trees, vineyards, hops, or bush fruits on the farm on January 1, 1938 (excluding non-bearing orchards and vineyards), from which the principal part of the production is normally sold.

Cotton means cotton the staple of which is normally less than 1⅛ inches in length. American-Egyptian cotton, Sea Island cotton, and any other cotton, the staple of which is normally 1⅛ inches or more in length shall be considered as a general soil-depleting crop and not as cotton in connection with the 1938 Agricultural Conservation Program.

Commercial vegetables means the acreage of vegetables or truck crops (including potatoes on farms where a potato acreage allotment is not established, sweet potatoes, tomatoes, sweet corn, melons, cantaloupes, strawberries, and commercial bulbs and flowers, but excluding peas for canning and sweet corn for canning and artichokes for use other than as vegetables) of which the prinicipal part of the production is sold to persons not living on the farm.

Peanuts for market means only those peanuts separated from the vines by mechanical means and from which the principal part of the production is sold to persons off the farm.

Soil conserving acreage means the total acreage of cropland in any class A farm in excess of the total soil-depleting acreage allotment established for the farm.

Noncrop open pasture means pasture land (other than rotation pasture land and range land) on which the predominant growth is forage suitable for grazing and on which the number or grouping of any trees or shrubs is such that the land could not fairly be considered as woodland.

Commercial corn-producing area means the area included in the following counties of the States specified:

ILLINOIS: All counties.

INDIANA: All counties except Brown, Clark, Crawford, Floyd, Harrison, Jefferson, Lawrence, Martin, Monroe, Ohio, Orange, Perry, Scott, Spencer, and Switzerland.

IOWA: All counties.

MICHIGAN: Branch, Hillsdale, Lenawee, Monroe, and St. Joseph.

MINNESOTA: Big Stone, Blue Earth, Brown, Carver, Chippewa, Cottonwood, Dakota, Dodge, Faribault, Fillmore, Freeborn, Goodhue, Grant, Houston, Jackson, Kandiyohi, Lac Qui Parle, Le Sueur, Lincoln, Lyon, McLeod, Martin, Meeker, Mower, Murray, Nicollet, Nobles, Olmstead, Pipestone, Redwood, Renville, Rice, Rock, Scott, Sibley, Steele, Stevens, Swift, Traverse, Wabasha, Waseca, Watonwan, Winona, Wright, and Yellow Medicine.

MISSOURI: Adair, Andrew, Atchison, Audrain, Barton, Bates, Benton, Boone, Buchanan, Caldwell, Callaway, Cape Girardeau, Carroll, Cass, Chariton, Clark, Clay, Clinton, Cooper, Daviess, DeKalb, Gentry, Grundy, Harrison, Henry, Holt, Howard, Jackson, Johnson, Knox, Lafayette, Lewis, Lincoln, Linn, Livingston, Macon, Marion, Mercer, Mississippi, Moniteau, Monroe, Montgomery, New Madrid, Nodaway, Pemiscot, Perry, Pettis, Pike, Platte, Putnam, Ralls, Randolph, Ray, St. Charles, St. Clair, Saline, Schuyler, Scotland, Scott, Shelby, Stoddard, Vernon, and Worth.

NEBRASKA: All counties except Arthur, Banner, Blaine, Box Butte, Brown, Chase, Cherry, Cheyenne, Dawes, Deuel, Garden, Garfield, Grant, Holt, Hooker, Keith, Keyapaha, Kimball, Lincoln, Logan, Loup, McPherson, Morrill, Rock, Scotts Bluff, Sheridan, Sioux, Thomas, and Wheeler.

OHIO: All counties except Ashtabula, Athens, Belmont, Carroll, Columbiana, Cuyahoga, Gallia, Geauga, Guernsey, Harrison, Hocking, Jackson, Jefferson, Lake, Lawrence, Lorain, Mahoning, Medina, Meigs, Monroe, Morgan, Muskingum, Noble, Portage, Stark, Summit, Trumbull, Tuscarawas, Vinton, Washington, and Wayne.

SOUTH DAKOTA: Bon Homme, Brookings, Charles Mix, Clay, Davison, Douglas, Hanson, Hutchinson, Kingsbury, Lake, Lincoln, McCook, Minnehaha, Moody, Turner, Union, and Yanktown.

WISCONSIN: Dane, Grant, Green, Iowa, Lafayette, and Rock.

KANSAS: Anderson, Atchison, Brown, Coffey, Crawford, Doniphan, Douglas, Franklin, Jackson, Jefferson, Jewell, Johnson, Leavenworth, Linn, Lyon, Marshall, Miami, Nemaha, Norton, Osage, Phillips, Pottawatomie, Republic, Riley, Shawnee, Smith, and Washintgon

KENTUCKY: Fulton, Henderson, Hickman, and Union.

General soil-depleting crops means all soil-depleting crops other than sugar beets and sugarcane for sugar and those for which individual crop acreage allotments are established on the farm.

Animal unit means one cow, one horse, five sheep, or five goats, two calves, or two colts, or the equivalent thereof.

Early potato-producing area means all the States in the East Central and Southern Regions, the States of Missouri and Kansas, the counties of Kern,

Los Angeles, Riverside, San Bernardino, San Diego, and Santa Barbara in the State of California, the counties of Clark, Floyd, and Harrison in the State of Indiana, and the counties of Dawson and Buffalo in Nebraska.

Late potato-producing area means the area not included in the early potato-producing area.

Done at Washington, D. C., this 10th day of October 1939. Witness my hand and the seal of the Department of Agriculture.[1]

H. A. WALLACE,
Secretary of Agriculture.

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[1] This is the attestation of Supplement No. 27 to the 1938 Agricultural Conservation Program Bulletin. Attestations similar to that above appeared on the 1938 Agricultural Conservation Program Bulletin, approved October 23, 1937, and on each of the supplements 1 to 27, inclusive, which are included herein. Supplements 1 to 27, inclusive, to the 1938 Agricultural Conservation Program Bulletin were approved on the following dates: Supplement No. 1, January 10, 1938; Supplement No. 2, February 1, 1938; Supplement No. 3, March 24, 1938; Supplement No. 4, March 21, 1938; Supplement No. 5, April 8, 1938; Supplement No. 6, April 13, 1938; Supplement No. 7, April 16, 1938; Supplement No. 8, April 28, 1938; Supplement No. 9, May 25, 1938; Supplement No. 10, July 11, 1938; Supplement No. 11, August 5, 1938; Supplement No. 12, December 21, 1938; Supplement No. 13, September 1, 1938; Supplement No. 14, October 6, 1938; Supplement No. 15, October 21, 1938; Supplement No. 16, October 28, 1938; Supplement No. 17, November 16, 1938; Supplement No. 18, December 30, 1938; Supplement No. 19, December 21, 1938; Supplement No. 20, December 29, 1938; Supplement No. 21, January 25, 1939; Supplement No. 22, January 19, 1939; Supplement No. 23, May 17, 1939; Supplement No. 24, May 24, 1939; Supplement No. 25, July 14, 1939; Supplement No. 26, August 11, 1939; Supplement No. 27, October 10, 1939.

APPENDIX B.—1938 CONSERVATION PROGRAMS—STATISTICAL SUMMARY — (PRELIMINARY, AS OF JULY 1, 1939)

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Table No. 1.—PARTICIPATION AND ESTIMATED GROSS PAYMENTS, 1938 AGRICULTURAL CONSERVATION PROGRAM (PRELIMINARY, AS OF JULY 1, 1939)

State and Region	Applications, farms [1]	Cropland on application	Total cropland in State	Cropland covered	Payees [2]	Estimated gross payments [2]	Average payment per payee [2]
	Number	*Acres*	*Acres*	*Percent*	*Number*	*Dollars*	*Dollars*
Maine	14,700	847,764	1,451,246	58.4	14,876	1,912,911	128.59
New Hampshire	5,200	212,938	451,078	47.2	5,216	187,668	35.98
Vermont	8,620	605,799	1,149,757	52.7	8,730	519,786	59.54
Massachusetts	7,560	254,392	586,748	43.4	7,583	425,704	56.14
Rhode Island	598	25,004	75,033	33.3	598	33,895	56.68
Connecticut	4,730	194,217	531,454	36.5	4,758	434,971	91.42
New York	43,500	3,348,898	8,445,732	39.7	44,761	3,254,670	72.71
New Jersey	11,775	712,388	1,050,725	67.8	12,567	1,171,612	93.23
Pennsylvania	57,000	3,801,454	8,024,654	47.4	60,648	3,653,700	60.24
Total Northeast Region	153,683	10,002,854	21,766,427	46.0	159,737	11,594,917	72.59
Illinois	114,760	12,144,068	23,078,768	52.6	114,760	18,406,538	160.39
Indiana	106,997	7,675,452	13,523,837	56.8	102,224	10,502,185	102.74
Iowa	143,504	15,400,844	24,228,896	63.6	143,604	28,201,937	196.39
Michigan	121,549	7,321,002	10,731,946	68.2	121,549	6,427,270	52.88
Minnesota	137,412	13,450,376	19,469,395	69.1	137,412	15,829,134	115.19
Missouri	128,945	11,164,862	16,054,617	69.5	128,945	13,133,042	101.85
Nebraska	78,146	11,680,932	20,446,092	57.1	80,834	13,015,371	161.01
Ohio	106,501	6,685,718	12,875,572	51.9	112,222	8,697,650	77.50
South Dakota	95,944	14,578,404	16,842,968	86.6	101,794	13,864,368	136.20
Wisconsin	142,870	9,516,625	11,578,447	82.2	150,742	9,738,852	64.61
Total North Central Region	1,176,628	109,618,283	168,830,538	64.9	1,194,086	137,816,347	115.42
Delaware	6,913	480,600	580,538	82.8	9,678	579,754	60.53
Maryland	21,073	1,654,300	2,425,921	68.2	25,498	1,557,613	61.09
Virginia	81,340	3,939,500	5,449,584	72.3	101,675	4,386,814	43.15
West Virginia	39,887	1,344,000	1,951,634	68.9	40,286	1,202,092	29.84
North Carolina	173,300	6,556,000	7,988,855	82.1	291,144	14,503,879	49.82
Kentucky	159,252	9,928,300	11,348,510	87.5	240,471	9,409,750	39.13
Tennessee	151,581	8,465,200	9,927,913	85.3	256,172	10,944,453	42.72
Total East Central Region	633,346	32,367,900	39,672,955	81.6	964,924	42,584,355	44.13

[1] For the North Central Region, data are numbers of applications, which exceed number of application farms.

[2] Includes range and naval store conservation programs.

Table No. 1.—PARTICIPATION AND ESTIMATED GROSS PAYMENTS, 1938 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and Region	Applications, farms	Cropland on application	Total cropland in State	Cropland covered	Payees	Estimated gross payments	Average payment per payee
	Number	*Acres*	*Acres*	*Percent*	*Number*	*Dollars*	*Dollars*
Alabama	181,700	8,481,000	9,206,026	92.1	291,232	17,276,937	59.32
Arkansas	147,200	8,510,000	9,200,132	92.5	276,000	17,187,000	62.27
Florida	37,500	1,615,000	2,479,266	65.1	41,268	2,964,105	71.83
Georgia	157,000	9,293,000	11,282,894	82.4	261,034	17,827,165	68.29
Louisiana	95,200	4,942,000	5,660,949	87.3	186,003	10,374,507	55.78
Mississippi	138,000	8,347,000	8,626,521	96.8	312,579	21,513,665	68.83
Oklahoma	169,900	14,390,000	18,723,016	76.9	240,470	17,355,000	72.17
South Carolina	105,800	5,231,000	5,696,978	91.8	167,089	12,033,472	72.02
Texas	355,400	35,850,000	39,647,414	90.4	596,731	62,979,619	105.54
Total Southern Region	1,387,700	96,659,000	110,523,196	87.5	2,372,406	179,511,470	75.67
Arizona	4,984	584,748	689,137	84.9	4,691	2,558,678	545.44
California	70,505	4,931,419	9,099,899	54.2	61,752	7,610,535	123.24
Colorado	40,494	6,757,435	8,307,124	81.3	40,989	4,882,244	119.11
Idaho	22,345	2,677,678	3,898,727	68.7	19,768	2,344,637	118.61
Kansas	76,886	15,336,962	28,751,233	53.3	109,995	15,696,536	142.70
Montana	49,457	9,435,532	10,227,971	92.3	44,396	7,298,367	164.39
Nevada	1,448	189,963	377,686	50.3	1,569	112,769	71.87
New Mexico	15,606	1,738,687	2,405,576	72.3	17,361	3,316,549	191.03
North Dakota	113,486	21,035,448	24,181,128	87.0	107,282	17,780,412	165.74
Oregon	27,402	3,220,496	3,887,127	82.9	28,743	3,139,063	109.21
Utah	13,486	907,128	1,392,584	65.1	15,031	624,060	41.52
Washington	26,304	3,758,027	6,245,684	60.2	26,027	3,587,141	137.82
Wyoming	9,374	1,471,918	1,999,464	73.6	11,872	1,626,521	137.00
Total Western Region	471,777	72,045,441	101,463,340	71.0	489,476	70,577,482	144.19
Alaska					40	1,050	26.25
Hawaii					688	101,000	146.80
Puerto Rico					67,439	1,504,617	22.31
Total Insular Region					68,167	1,606,667	23.57
United States total	3,823,134	320,693,478	442,256,456	72.5	5,248,796	443,691,238	84.53

Table No. 2.—ESTIMATED GROSS PAYMENTS,[1] BY STATES AND COMMODITIES, 1938 AGRICULTURAL CONSERVATION PROGRAM (PRELIMINARY, AS OF JULY 1, 1939)

[All figures in thousands of dollars, i. e., 000 omitted]

State and Region	Cotton	Corn, commercial	Wheat	Tobacco				
				Flue-cured	Burley	Dark	Cigar	Ga.-Fla.
Maine								
New Hampshire							1	
Vermont							1	
Massachusetts							72	
Rhode Island								
Connecticut							169	
New York			202				6	
New Jersey			30					
Pennsylvania			742				161	
Total Northeast Region			974				410	
Illinois	20	11,396	1,406		[2]			
Indiana		5,510	1,335		32	3		
Iowa		19,655	319					
Michigan		251	719					

[1] Includes amounts deducted for county association expenses.
[2] Less than $500.

Table No. 2.—ESTIMATED GROSS PAYMENTS, BY STATES AND COMMODITIES, 1938 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Con.

[All figures in thousands of dollars, i. e., 000 omitted]

State and Region	Cotton	Corn, commercial	Wheat	Tobacco				
				Flue-cured	Burley	Dark	Cigar	Ga.-Fla.
Minnesota		5,660	1,309				7	
Missouri	2,511	4,112	961		12			
Nebraska		6,356	2,005					
Ohio		3,521	1,483		39		71	
South Dakota		2,092	2,912					
Wisconsin		856	87				192	
Total North Central Region	2,531	59,409	12,536		83	3	270	
Delaware			157					
Maryland			452					
Virginia	316		311	408	48	311		
West Virginia			41		17			
North Carolina	6,976		73	3,901	44			
Kentucky	141	348	395		1,167	1,214		
Tennessee	5,319		109		262	744		
Total East Central Region	12,752	348	1,538	4,309	1,538	2,269		
Alabama	13,825			2				
Arkansas	13,647		7					
Florida	263			73			3	31
Georgia	12,998		3	571			2	4
Louisiana	7,695							
Mississippi	18,527							
Oklahoma	7,046		3,429					
South Carolina	9,404		12	564				
Texas	36,653		3,779					
Total Southern Region	120,058		7,230	1,210			5	35
Arizona	1,967		43					
California	3,356		389					
Colorado			968					
Idaho			1,355					
Kansas	2	1,287	8,742		1			
Montana			3,478					
Nevada			19					
New Mexico	1,023		294					
North Dakota			8,240					
Oregon			1,689					
Utah			324					
Washington			2,418					
Wyoming			221					
Total Western Region	6,348	1,287	28,180		1			
Alaska								
Hawaii								
Puerto Rico								
Total Insular Region								
United States total	141,689	61,044	50,458	5,519	1,622	2,272	685	35

State and Region	Potatoes commercial	Peanuts for nuts	Rice	General diversion	Soil-building practices	Restoration land	Range	Naval stores	Total gross payments
Maine	1,437				476				1,913
New Hampshire	20				167				188
Vermont	15				504				520
Massachusetts	44				310				426
Rhode Island	7				27				34
Connecticut	61				205				435
New York	348				2,699				3,255
New Jersey	221				920				1,171
Pennsylvania	267				2,484				3,654
Total Northeast Region	2,420				7,792				11,596

Table No. 2.—ESTIMATED GROSS PAYMENTS, BY STATES AND COMMODITIES, 1938 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Con.

[All figures in thousands of dollars, i. e., 000 omitted]

State and Region	Potatoes commercial	Peanuts for nuts	Rice	General diversion	Soil-building practices	Restoration land	Range	Naval stores	Total gross payments
Illinois				3,627	1,957				18,406
Indiana	52			2,145	1,425				10,502
Iowa				5,587	2,641				28,202
Michigan	551			3,419	1,487				6,427
Minnesota	275			6,957	1,621				15,829
Missouri	32			2,990	2,516				13,134
Nebraska	131			3,016	853	109	545		13,015
Ohio	62			2,067	1,454				8,697
South Dakota	42			6,553	955	427	883		13,864
Wisconsin	223			6,214	2,168				9,740
Total North Central Region	1,368			42,575	17,077	536	1,428		137,816
Delaware	6				417				580
Maryland	58				1,048				1,558
Virginia	303	207			2,483				4,387
West Virginia					1,144				1,202
North Carolina	217	348			2,944				14,503
Kentucky	38				6,107				9,410
Tennessee					4,510				10,944
Total East Central Region	622	555			18,653				42,584
Alabama	7	249			3,091			103	17,277
Arkansas			292	835	2,406				17,187
Florida	106	36			2,141			311	2,964
Georgia		268			3,462			519	17,827
Louisiana			985		1,691			3	10,374
Mississippi					2,966			21	21,514
Oklahoma	10	21		5,484	955	61	349		17,355
South Carolina	96				1,919			38	12,033
Texas		88	378	11,336	4,093	38	6,613	2	62,980
Total Southern Region	219	662	1,655	17,655	22,724	99	6,962	997	179,511
Arizona					128		421		2,559
California	184		254	1,446	1,764		217		7,610
Colorado	400			2,175	905	141	293		4,882
Idaho	317				613		59		2,344
Kansas	36			4,100	1,243	120	166		15,697
Montana	12			1,603	1,395	263	547		7,298
Nevada	3				49		42		113
New Mexico				577	332	48	1,043		3,317
North Dakota	208			6,711	2,315	266	40		17,780
Oregon	112				1,188		150		3,139
Utah	24				252		24		624
Washington	159				957		53		3,587
Wyoming	31			341	338	51	645		1,627
Total Western Region	1,486		254	16,953	11,479	889	3,700		70,577
Alaska									1
Hawaii									101
Puerto Rico									1,505
Total Insular Region									1,607
United States total	6,115	1,217	1,909	77,183	77,725	1,524	12,090	997	443,691

Table No. 3.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1938 AGRICULTURAL CONSERVATION PROGRAM (PRELIMINARY, AS OF JULY 1, 1939)

State and Region	New seedings						Renovation of perennial grasses and legumes
	Biennial and perennial legumes and perennial grasses [1]		Other legumes and annual grasses	Timothy and redtop	Planting sod pieces	Total	
	Alfalfa	Other [2]					
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Maine	96	95,241		1,465		96,802	
New Hampshire	912	14,558		949		16,419	
Vermont	3,928	39,087				43,015	
Massachusetts	2,161	12,903				15,064	
Rhode Island	112	1,435		144		1,691	
Connecticut	2,462	4,185				6,647	
New York	50,372	298,551				348,923	1,442
New Jersey	25,035	49,393				74,428	
Pennsylvania	63,400	316,435				379,835	
Total Northeast Region	148,478	831,788		2,558		982,824	1,442
Illinois		1,465,532	224,107	217,921		1,907,560	
Indiana		1,022,073	183,390	133,759		1,339,222	
Iowa		2,270,981	38,548	337,256		2,646,785	
Michigan		865,641	39,044	22,186		926,871	
Minnesota		1,319,345	18,165	26,109		1,363,619	
Missouri		409,481	994,742	717,116		2,121,339	
Nebraska		167,498	2,912	705		171,115	
Ohio		1,027,437	22,948	214,530		1,264,915	
South Dakota		411,526	3,936	4,022		419,484	
Wisconsin		1,365,284	14,855	71,429		1,451,568	
Total North Central Region		10,324,798	1,542,647	1,745,033		13,612,478	
Delaware	951	35,091	93,425	36,938		166,405	
Maryland	13,321	299,004	96,513	153,142		561,980	
Virginia	13,012	315,807	404,119	157,811		890,749	
West Virginia	12,890	158,648	39,839	109,608		320,985	
North Carolina	1,563	69,529	782,529	10,481		864,102	
Kentucky	58,746	758,976	1,402,662	424,485		2,644,869	
Tennessee	21,717	245,092	1,643,877	133,281		2,043,967	
Total East Central Region	122,200	1,882,147	4,462,964	1,025,746		7,493,057	
Alabama		23,736	611,793	320	276	636,125	
Arkansas		89,792	732,833	7,894	14,368	844,887	
Florida		906	17,423		3,656	21,985	
Georgia		21,570	406,365	952	1,624	430,511	
Louisiana		78,480	264,798	64	427	343,769	
Mississippi		68,626	860,795		543	929,964	
Oklahoma		100,997	106,930	1,586	9,624	219,137	
South Carolina		9,553	207,790	36	198	217,577	
Texas		164,260	85,750	20,610	28,914	299,534	
Total Southern Region		557,920	3,294,477	31,462	59,630	3,943,489	
Arizona		55,502	6,815			62,317	56,544
California		228,618	28,770	40		257,428	115,454
Colorado		229,972		522		230,494	116,988
Idaho		261,870	319	1,216		263,405	148,956
Kansas		175,387	65,115	6,034	4	246,540	
Montana		430,296	3,574	1,912		435,782	67,010
Nevada		14,670	310	194		15,174	23,132
New Mexico		48,482	1,412			49,894	15,058
North Dakota		1,432,197		2,778		1,434,975	
Oregon		278,698	220,430	1,126		500,254	64,570
Utah		73,975		254		74,229	5,070
Washington		320,352	22,834	1,018		344,204	126,632
Wyoming		126,177		1,964		128,141	67,814
Total Western Region		3,676,196	349,579	17,058	4	4,042,837	807,228
United States total	270,678	17,272,849	9,649,667	2,821,857	59,634	30,074,685	808,670

[1] Excludes timothy and redtop and mixtures consisting of timothy and redtop.
[2] Includes alfalfa, except in Northeast and East Central Regions.

Table No. 3.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1938 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and Region	Green manure and cover crops						Mulching
	On vegetable land	Summer legumes	Sorghums and Sudan grass left on land	Natural vegetable cover or small grain stubble left on land	Other and unclassified	Total	
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Tons*
Maine					27,707	27,707	2,700
New Hampshire					3,248	3,248	1,734
Vermont					3,764	3,764	942
Massachusetts					29,478	29,478	9,221
Rhode Island					2,962	2,962	121
Connecticut					21,627	21,627	1,323
New York					101,253	101,253	116,589
New Jersey					168,913	168,913	52,881
Pennsylvania					75,438	75,438	2,142
Total Northeast Region					434,390	434,390	187,653
Illinois					5,367	5,367	856
Indiana					7,758	7,758	1,208
Iowa					1,846	1,846	120
Michigan					53,694	53,694	8,750
Minnesota					1,705	1,705	39
Missouri							687
Nebraska			1,212		18,600	19,812	
Ohio					6,887	6,887	3,433
South Dakota			506		47,069	47,575	
Wisconsin					3,991	3,991	1,295
Total North Central Region			1,718		146,917	148,635	16,388
Delaware	21	12			95,052	95,085	
Maryland	10,408	1,630			89,102	101,140	
Virginia	30,857	70,987			189,485	291,329	
West Virginia		596			26,389	26,985	
North Carolina	1,906	964,365			603,639	1,569,910	
Kentucky		4,087			151,216	155,303	
Tennessee	112	276,059			219,898	496,069	
Total East Central Region	43,304	1,317,736			1,374,781	2,735,821	
Alabama	49	1,457,166			511,348	1,968,563	2,022
Arkansas	82	1,068,120			460,943	1,529,145	868
Florida	142,268	117,804			746,299	1,006,371	2,886
Georgia	303	2,040,588			630,917	2,671,808	2,632
Louisiana	2,552	1,255,858			366,375	1,624,785	2,500
Mississippi	2,116	1,612,218			985,518	2,599,852	
Oklahoma		102,690	382,488	122,910	364,719	972,807	118
South Carolina	5,080	1,159,856			445,071	1,610,007	712
Texas	416	895,712	174,476	231,940	2,171,803	3,474,347	1,062
Total Southern Region	152,866	9,710,012	556,964	354,850	6,682,993	17,457,685	12,800
Arizona	2,924				12,857	15,781	
California	5,472				1,623,109	1,628,581	61,382
Colorado	18		360,948	338,000	198,696	897,662	3,938
Idaho					30,682	30,682	300
Kansas			562,040	788,130	143,689	1,493,859	252
Montana	5		336		2,341	2,682	940
Nevada					398	398	
New Mexico		98	37,596	67,460	49,980	155,134	
North Dakota			384		89,766	90,150	
Oregon	1,142				75,087	76,229	26,768
Utah					3,976	3,976	340
Washington	88				69,852	69,940	23,025
Wyoming			124		1,940	2,064	
Total Western Region	9,649	98	961,428	1,193,590	2,302,373	4,467,138	116,945
United States total	205,819	11,027,846	1,520,110	1,548,440	10,941,454	25,243,669	333,786

Table No. 3.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1938 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and Region	Forest tree practices					Fertilizer and lime applications	
	Planting trees	Maintaining stands	Improving stands	Nongrazing woodlots	Total	Limestone	16 percent superphosphate or equivalent
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Tons*	*Tons*
Maine	73		1,339	1,696	3,108	31,620	8,898
New Hampshire	116		3,416	811	4,343	12,443	5,437
Vermont	454		1,195	18,598	20,247	20,996	26,451
Massachusetts	131		777	960	1,868	26,044	6,853
Rhode Island	3		17	60	80	3,192	609
Connecticut	149		223		372	31,463	5,523
New York	2,822		580	5,617	9,019	275,494	74,509
New Jersey	145		250		395	94,063	6,505
Pennsylvania	1,749		166	3,203	5,118	665,938	19,330
Total, Northeast Region	5,642		7,963	30,945	44,550	1,161,253	154,115
Illinois	30	140	10		180	579,332	2,391
Indiana	150	156	38		344	201,723	216
Iowa	69	140	10		219	203,010	215
Michigan	648	647	2,562		3,857	156,111	1,068
Minnesota	732	1,387	28,990		31,109	15,914	147
Missouri	136	41	564		741	205,494	1,157
Nebraska	3,909	4,536	10		8,455	529	14
Ohio	126	94	61		281	202,017	2,066
South Dakota	5,150	9,781	23		14,954		
Wisconsin	645	163	2,309		3,117	182,668	828
Total, North Central Region	11,595	17,085	34,577		63,257	1,746,798	8,102
Delaware	23		8		31	25,100	3,229
Maryland	41		97		138	160,061	10,867
Virginia	432		506		938	393,473	44,630
West Virginia	125		780		905	225,842	38,689
North Carolina	1,144		2,392		3,536	82,253	5,309
Kentucky	513		1,923		2,436	784,551	97,797
Tennessee	2,913		134		3,047	337,560	33,567
Total, East Central Region	5,191		5,840		11,031	2,008,840	234,088
Alabama	1,491	1,680			3,171	16,910	29,518
Arkansas	384	550			934	14,763	506
Florida	3,678	3,226			6,904	17,815	33,681
Georgia	13,221	6,054			19,275	4,569	3,727
Louisiana	504	500			1,004	329	973
Mississippi	1,421	832			2,253	602	11,016
Oklahoma	964	7,834			8,798	2,273	88
South Carolina	1,865	4,542			6,407	5,496	1,008
Texas	989	6,176			7,165	8	1,972
Total, Southern Region	24,517	31,394			55,911	62,765	82,489
Arizona							1,238
California	282	380			662		3,445
Colorado	93	286			379		611
Idaho	16	58			74	210	2,947
Kansas	3,792	5,147			8,939	16,939	541
Montana	273	252			525		368
Nevada	20				20		189
New Mexico	18	78			96		2,800
North Dakota	3,804	7,018			10,822		40
Oregon	23	38			61	17,685	2,234
Utah	8				8		878
Washington	33	37			70	4,802	2,392
Wyoming	138	242			380		161
Total, Western Region	8,500	13,536			22,036	39,636	17,844
United States total	55,445	62,015	48,380	30,945	196,785	5,019,292	496,638

Table No. 3.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1938 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and Region	Fertilizer and lime applications			Pasture practices				
					Reseeding pastures			
	Muriate of potash	Gypsum	Total	Seeding pasture mixtures	Natural (by deferred grazing)	Artificial	Contour ridging	Total (excluding artificial reseeding and contour ridging)
	Tons	*Tons*	*Tons*	*Acres*	*Acres*	*Pounds*	*1,000 linear feet*	*Acres*
Maine	680		41,198	153		1,980		153
New Hampshire	376		18,256	332		6,740		332
Vermont	812		48,259	197				197
Massachusetts	1,146		34,043	364		1,790		364
Rhode Island	131		3,932	12		290		12
Connecticut	280		37,266	719				719
New York	161		350,164	4,147				4,147
New Jersey	1,118		101,686	2,623				2,623
Pennsylvania	2,052		687,320	1,991		1,680		1,991
Total, Northeast Region	6,756		1,322,124	10,538		12,480		10,538
Illinois	252	2	581,977		5,902	21,287		5,902
Indiana	18	2	201,959		284	30,514		284
Iowa	5	2	203,232		2,675	91,990		2,675
Michigan	241		157,420			21,020		
Minnesota	7	52	16,120		186	14,852		186
Missouri			206,651		8,881	1,355,365		8,881
Nebraska			543		321,248	32,654		321,248
Ohio	5	8	204,096		289	22,780		289
South Dakota					1,296,319	192,029		1,296,319
Wisconsin	169	2	183,667		9,687	185,147		9,687
Total, North Central Region	697	68	1,755,665		1,645,471	1,967,638		1,645,471
Delaware	819		29,148			100		
Maryland	1,613		172,541			28,270		
Virginia	1,608		439,711			756,685		
West Virginia	434		264,965					
North Carolina	51		87,613			365,875		
Kentucky	10		882,358			1,640,119		
Tennessee	46		371,173			1,358,827		
Total, East Central Region	4,581		2,247,509			4,149,876		
Alabama			46,428	23,114		222,100	2,244	23,114
Arkansas			15,269	27,846		352,400	406	27,846
Florida			51,496	58,534		33,700	98	58,534
Georgia			8,296	14,734		43,200	2,008	14,734
Louisiana			1,302	35,819		80,200	138	35,819
Mississippi			11,618	17,578		197,700	3,509	17,578
Oklahoma			2,361		30,013	70,600	3,376	30,013
South Carolina			6,504	3,330		46,600	264	3,330
Texas			1,980	1,224	25,905	157,300	3,999	27,129
Total, Southern Region			145,254	182,179	55,918	1,203,800	16,042	238,097
Arizona			1,238					
California		3,864	7,309		8,932	59,120		8,932
Colorado			611		27,311	53,810		27,311
Idaho		1,045	4,202		410	55,490		410
Kansas			17,480		117,161	360,000		117,161
Montana		161	529		45,613	87,070		45,613
Nevada			189		466	10,490		466
New Mexico	1	150	2,951		1,039	16,110		1,039
North Dakota			40		71,376	155,830		71,376
Oregon		13,596	33,515		5,696	605,280		5,696
Utah			878		9,949	52,100		9,949
Washington		145	7,339		14,434	286,500		14,434
Wyoming			161		8,974	50,710		8,974
Total, Western Region	1	18,961	76,442		311,361	1,792,510		311,361
United States total	12,035	19,029	5,546,994	192,717	2,012,750	9,126,304	16,042	2,205,467

Table No. 3.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1938 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and Region	Erosion-control practices						
	Terracing	Construction of dams and reservoirs	Protecting muck land by windbreaks	Protected summer fallow	Strip cropping	Contour listing or furrowing noncropland	Contour farming intertilled crops
	1,000 linear feet	*Cubic yards*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Maine					82		442
New Hampshire					2		3
Vermont							
Massachusetts							
Rhode Island							
Connecticut							
New York	33		1,837		10,937		534
New Jersey					423		
Pennsylvania	2				4,409	196	
Total Northeast Region	35		1,837		15,853	196	979
Illinois	42				464	34	93
Indiana	22				55	122	
Iowa	44				96	8	2,416
Michigan							
Minnesota					6,444	583	790
Missouri	2,180				280	826	1,192
Nebraska	173			531,358	28,930	440	17,842
Ohio					1,405		
South Dakota	11			328,412	198,746	116	1,896
Wisconsin	12				8,730	30	12
Total North Central Region	2,484			859,770	245,150	2,159	24,241
Delaware	6						
Maryland	5						
Virginia	2,260						
West Virginia							
North Carolina	14,734						
Kentucky	720						
Tennessee	14,006						
Total East Central Region	31,731						
Alabama	87,705				672	188	
Arkansas	17,474				832	248	352
Florida	5,424						
Georgia	35,518				404	240	
Louisiana	12,171				40	128	
Mississippi	45,749				388		
Oklahoma	26,581	486,540		102,932	8,128	8,432	375,560
South Carolina	13,658				760	1,568	
Texas	104,264	2,161,455		714,396	129,972	37,148	3,580,504
Total Southern Region	348,544	2,647,995		817,328	141,196	47,952	3,956,416
Arizona							
California	430	359,385			48	312	
Colorado	106	90,420		545,636	54,884	13,644	48,496
Idaho		2,415		180,980			
Kansas	2,868	359,115		1,436,004	4,196	15,100	65,536
Montana	512	500,370		1,656,004	169,756	420	1,600
Nevada		1,995					
New Mexico	5,312	243,120		111,268	21,888	15,112	413,000
North Dakota		1,037,175		894,780	39,312	1,000	240
Oregon	6	5,730		290,704		24	
Utah	8	29,355		119,804			
Washington		1,560		483,952	484	436	
Wyoming		359,490		74,980	20,440	112	
Total Western Region	9,242	2,990,130		5,794,112	311,008	46,160	528,872
United States total	392,036	5,638,125	1,837	7,471,210	713,207	96,467	4,510,508

Table No. 3.—SOIL-BUILDING PRACTICES CARRIED OUT UNDER THE 1938 AGRICULTURAL CONSERVATION PROGRAM, ETC.—Continued

State and Region	Erosion-control practices				Sanding cranberry bogs	Weed control
	Contour seeding small grain crops	Contour listing and basin listing on the contour	Other basin listing	Total (excludes terracing, reservoirs, and dams)		
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Maine				524		
New Hampshire				5		
Vermont						
Massachusetts					3,097	
Rhode Island					30	
Connecticut						
New York				13,308		
New Jersey				423	617	
Pennsylvania				4,605		
Total Northeast Region				18,865	3,744	
Illinois				591	10	
Indiana				177		
Iowa				2,520		
Michigan						
Minnesota				7,817		
Missouri				2,298		
Nebraska		5,910	2,532	587,012		
Ohio		2		1,407		
South Dakota		1,500	1,393	532,063		
Wisconsin				8,772	284	
Total North Central Region		7,412	3,925	1,142,657	294	
Delaware						
Maryland						
Virginia						
West Virginia						
North Carolina						
Kentucky						
Tennessee						
Total East Central Region						
Alabama				860		
Arkansas	580			2,012		
Florida						
Georgia				644		
Louisiana				168		
Mississippi				388		
Oklahoma	132,120	111,232	9,060	747,464		87
South Carolina				2,328		
Texas	689,400	1,669,712	179,430	7,000,562		4
Total Southern Region	822,100	1,780,944	188,490	7,754,426		91
Arizona						806
California	10,380			10,740		2,146
Colorado	15,520	81,024	13,490	772,694		214
Idaho	3,320			184,300		3,351
Kansas	57,640	26,464	59,360	1,664,300		8,776
Montana	1,920		3,150	1,832,850		5,478
Nevada						109
New Mexico	54,580	49,704		665,552		13
North Dakota	460		340	936,132		2,752
Oregon	520			291,248		7,096
Utah	14,470			134,274		3,011
Washington	1,030			485,902		8,285
Wyoming	490	224	120	96,366		1,727
Total Western Region	160,330	157,416	76,460	7,074,358		43,764
United States total	982,430	1,945,772	268,875	15,990,306	4,038	43,855

Table No. 4.—1938 RANGE CONSERVATION PROGRAM—STATISTICS OF PARTICIPATION (PRELIMINARY, AS OF JULY 1, 1939)

State and Region	Applications	Range land	Grazing capacity, animal units	Range land per animal unit
	Number	*Acres*	*Number*	*Acres*
Nebraska	2,688	9,926,295	553,078	17.9
South Dakota	5,592	13,058,908	621,199	21.0
Total North Central Region	8,280	22,985,203	1,174,277	19.6
Oklahoma	1,950	4,310,000	340,300	12.7
Texas	20,750	74,493,000	4,530,000	16.4
Total Southern Region	22,700	78,803,000	4,870,300	16.2
Arizona	476	9,346,668	225,669	41.4
California	1,143	4,851,486	257,318	18.9
Colorado	1,575	6,696,890	163,321	41.0
Idaho	449	1,639,214	42,107	38.9
Kansas	1,018	2,677,054	134,750	19.9
Montana	2,850	14,665,906	328,708	44.6
Nevada	131	1,261,023	29,493	42.8
New Mexico	2,539	24,743,349	653,123	37.9
North Dakota	302	971,874	28,598	34.0
Oregon	990	4,604,182	122,229	37.7
Utah	286	1,125,288	21,833	51.5
Washington	428	1,667,458	42,725	39.0
Wyoming	2,001	13,812,662	389,189	35.5
Total Western Region	14,188	88,063,054	2,439,063	36.1
United States total	45,168	189,851,257	8,483,640	22.4

Table No. 5.—RANGE-BUILDING PRACTICES—1938 RANGE CONSERVATION PROGRAM (PRELIMINARY, AS OF JULY 1, 1939)

State and Region	Reseeding range land		Erosion and run-off control	
	Natural, by deferred grazing	Artificial	Contour listing, furrowing, or subsoiling	Contour ridging
	Acres	*Pounds*	*Acres*	*1,000 feet*
Nebraska	2,324,234	7,537	407	----------
South Dakota	3,439,344	19,719	1,241	----------
Total, North Central Region	5,763,578	27,256	1,648	----------
Oklahoma	873,000	38,000	3,300	465
Texas	5,198,000	560,000	66,200	58,222
Total, Southern Region	6,071,000	598,000	69,500	58,687
Arizona	689,904	700	1,716	----------
California	874,212	52,376	----------	----------
Colorado	2,143,352	197,147	17,740	----------
Idaho	470,482	50,833	8,622	----------
Kansas	665,134	8,748	697	----------
Montana	4,227,838	200,940	----------	----------
Nevada	261,486	26,908	57,101	----------
New Mexico	3,628,909	34,523	----------	----------
North Dakota	273,674	6,183	----------	----------
Oregon	969,440	101,949	----------	----------
Utah	219,596	9,867	----------	----------
Washington	387,474	8,056	----------	----------
Wyoming	1,430,997	49,416	1,008	----------
Total, Western Region	16,242,498	747,646	86,884	----------
United States total	28,077,076	1,372,902	158,032	58,687

Table No. 5.—RANGE-BUILDING PRACTICES—1938 RANGE CONSERVATION PROGRAM (PRELIMINARY, AS OF JULY 1, 1939)—Continued

State and Region	Erosion and run-off control—Continued		Water development			
	Construction of spreader dams	Construction of spreader terraces	Construction of earthen tanks or reservoirs	Construction of rubble masonry dams	Drilling or digging wells	Development of springs or seeps
	Cu. yards	*Lin. feet*	*Cu. yards*	*Cu. yards*	*Lin. feet*	*Cu. feet*
Nebraska	11,231	9,289	215,044		111,409	8,891
South Dakota	121,586	26,605	2,941,849		14,522	95,320
Total, North Central Region	132,817	35,894	3,156,893		125,931	104,211
Oklahoma	6,100	67,000	1,564,000	2,400	14,400	111,950
Texas	1,408,000	6,482,000	18,501,000	66,900	514,400	34,900
Total, Southern Region	1,414,100	6,549,000	20,065,000	69,300	528,800	146,850
Arizona	199,954	35,852	2,122,423	1,746	25,593	39,138
California			187,966	190	8,946	114,619
Colorado	15,262	243,683	283,103	134	34,883	19,284
Idaho	2,287	13,604	10,817	9	315	18,524
Kansas			653,730		11,500	24,571
Montana	27,769	235,431	1,496,506		5,535	46,868
Nevada	5,888	2,640	25,064		4,493	9,217
New Mexico	366,410	474,339	3,602,110	1,030	79,083	21,193
North Dakota			95,989		1,518	10,782
Oregon	4,742		62,155		6,787	42,703
Utah	858		43,728	33	458	7,176
Washington			47,103	753	1,068	11,196
Wyoming	85,977	122,378	3,564,337		37,036	36,124
Total, Western Region	709,147	1,127,927	12,195,031	3,895	217,215	401,395
United States total	2,256,064	7,712,821	35,416,924	73,195	871,946	652,456

State and Region	Forestry practices		Elimination of destructive plants				Establishment of fire guards
	Planting trees	Maintaining a stand of trees	Prickly pear and cactus	Mesquite	Cedar	Lechuguilla	
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Lin. feet.*
Nebraska	3,016	664					
South Dakota	389	53					
Total, North Central Region	3,405	717					
Oklahoma	10		36,100	2,100	310		883,000
Texas	1,390		1,536,300	152,900	630,640	74,500	11,357,000
Total, Southern Region	1,400		1,572,400	155,000	630,950	74,500	12,240,000
California							5,133,475
Idaho							217,938
Montana							670,440
New Mexico							32,264
North Dakota							39,600
Oregon							121,440
Washington							583,929
Total, Western Region							6,799,086
United States, total	4,805	717	1,572,400	155,000	630,950	74,500	19,039,086

Table No. 6.—1938 AGRICULTURAL CONSERVATION PROGRAM—ESTIMATED NUMBER OF PAYEES RECEIVING PAYMENTS BY SIZE-OF-PAYMENT GROUPS, BY REGIONS (PRELIMINARY, AS OF JULY 1, 1939)

Size of payment	North-east	North Central	East Central	South-ern	West-ern	Insu-lar	Total United States
$0.00–$20.00	34, 689	199, 539	411, 952	476, 101	79, 785	49, 621	1, 251, 687
$20.01–$40.00	37, 991	189, 013	240, 626	633, 750	74, 653	9, 800	1, 185, 833
$40.01–$60.00	30, 399	162, 328	135, 632	456, 106	54, 422	3, 613	842, 500
$60.01–$100.00	33, 461	236, 374	112, 687	426, 832	79, 044	2, 558	890, 956
$100.01–$150.00	14, 291	159, 650	38, 465	183, 932	61, 292	1, 122	458, 752
$150.01–$200.00	4, 737	103, 342	13, 869	87, 563	43, 899	624	254, 034
$200.01–$300.00	2, 679	78, 373	6, 689	54, 671	41, 113	380	183, 905
$300.01–$400.00	702	33, 464	2, 215	21, 555	20, 894	176	79, 006
$400.01–$500.00	287	14, 496	1, 072	10, 696	11, 624	94	38, 269
$500.01–$1,000.00	255	15, 061	1, 343	15, 053	17, 125	131	48, 968
$1,000.01–$2,000.00	197	1, 954	279	4, 446	4, 266	28	11, 170
$2,000.01–$3,000.00	33	278	65	944	801	10	2, 131
$3,000.01–$4,000.00	2	94	19	353	236	4	708
$4,000.01–$5,000.00	6	50	4	167	125	1	353
$5,000.01–$10,000.00	7	58	6	190	148	2	411
Over $10,000.00	1	12	1	47	49	3	113
Total	159, 737	1, 194, 086	964, 924	2, 372, 406	489, 476	68, 167	5, 248, 796

Table No. 7.—1938 AGRICULTURAL CONSERVATION PROGRAM—ESTIMATED NUMBER OF PAYEES RECEIVING PAYMENTS IN VARIOUS SIZE-OF-PAYMENT GROUPS, EXPRESSED AS PERCENTAGES OF TOTAL PAYEES, BY REGIONS (PRELIMINARY, AS OF JULY 1, 1939)

Size of payment	North-east	North Central	East Central	South-ern	West-ern	Insular	Total, United States	Cumula-tive total, United States
$0.00–$20.00	21.72	16.71	42.69	20.07	16.30	72.79	23.85	23.85
$20.01–$40.00	23.78	15.83	24.94	26.71	15.25	14.38	22.59	46.44
$40.01–$60.00	19.03	13.60	14.06	19.23	11.12	5.30	16.05	62.49
$60.01–$100.00	20.95	19.80	11.68	17.99	16.15	3.75	16.98	79.47
$100.01–$150.00	8.95	13.37	3.99	7.75	12.52	1.64	8.74	88.21
$150.01–$200.00	2.96	8.66	1.44	3.69	8.97	.92	4.84	93.05
$200.01–$300.00	1.677	6.56	.69	2.31	8.40	.56	3.50	96.55
$300.01–$400.00	.439	2.80	.22	.91	4.27	.26	1.51	98.06
$400.01–$500.00	.180	1.21	.11	.45	2.38	.14	.73	98.79
$500.01–$1,000.00	.160	1.26	.14	.63	3.50	.192	.93	99.72
$1,000.01–$2,000.00	.123	.16	.029	.188	.87	.041	.21	99.93
$2,000.01–$3,000.00	.021	.023	.007	.040	.16	.015	.04	99.97
$3,000.01–$4,000.00	.001	.007	.002	.015	.05	.006	.013	99.983
$4,000.01–$5,000.00	.004	.004	.001	.007	.02	.001	.007	99.990
$5,000.01–$10,000.00	.004	.005	.001	.008	.03	.002	.008	99.998
Over $10,000.00	.001	.001	.0001	.002	.01	.003	.002	100.000
Total	100.000	100.000	100.000	100.000	100.00	100.000	100.000	

APPENDIX C.—WASHINGTON ORGANIZATION OF THE A. A. A.

The central administration in Washington is headed by the Administrator and an Assistant Administrator. Under their direction, the responsibility for carrying on the work of the Agricultural Adjustment Administration rests upon 6 regional directors, a director of information, and a consumers' counsel, each of whom is in charge of a division. Under an executive assistant likewise directly responsible to the Administrator, three smaller executive divisions—personnel management, general service, and fiscal management—make up the Office of the Executive Assistant to the Administrator.

The 6 regional directors are responsible for A. A. A. program operations in their respective geographical areas. Always in close contact with the Office of the Administrator as well as with the State committeemen and field representatives in the areas they service, their offices serve as clearinghouses in the two-way flow of administrative direction and information between Washington and the field.

The 6 regional divisions are geographical rather than type-of-farming areas, but each tends to place special emphasis on the major crop or type of farming that is characteristic of the region. The States and Territories comprising each of these regions, and the leading crop or type of farming in each, are as follows.

1. **The Southern Division:** South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Texas, and Oklahoma. Major crop: Cotton.
2. **The East Central Division:** Tennessee, Kentucky, North Carolina, Virginia, West Virginia, Maryland, and Delaware. Major crop: Tobacco.
3. **The Northeast Division:** Pennsylvania, New Jersey, New York, Connecticut, Massachusetts, Maine, Vermont, New Hampshire, and Rhode Island. Major type of farming: Dairying and general farming.
4. **The North Central Division:** Ohio, Michigan, Indiana, Illinois, Wisconsin, Iowa, Missouri, Nebraska, South Dakota, and Minnesota. Major crop: Corn.
5. **The Western Division:** North Dakota, Kansas, Colorado, Wyoming, Montana, New Mexico, Arizona, California, Utah, Nevada, Idaho, Oregon, and Washington. Major crops: Wheat and range-cattle.
6. **The Insular Division:** Puerto Rico, and the Territories of Alaska and Hawaii. Major crop: Sugarcane.

The Division of Consumers' Counsel is one of two nonregional divisions which are in charge of specialized activities covering the entire country rather than any particular region. It represents the

interests of the consumer in the programs and activities of the Administration. Its primary function is to see to it that administrative action to protect the interests of agricultural producers does not run counter to the equally valid interests of the consumers.

In addition to handling a large volume of consumer correspondence, the work of the division includes publication of Consumers' Guide, a biweekly magazine devoted exclusively to consumer interests.

The Division of Information is the other nonregional division with specialized Nation-wide activities. In general, it directs and supervises the informational activities of the Administration.

It is a service organization which cooperates with administrative divisions of the A. A. A., with State and county A. A. A. committees, extension services, vocational agriculture teachers, women's clubs, civic groups, farm organizations, farm journals, and newspapers in furnishing reliable information in appropriate practical forms, and by furnishing personnel to assist in planning and carrying out educational programs.

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REPORT OF THE CHIEF OF THE BUREAU OF AGRICULTURAL CHEMISTRY AND ENGINEERING, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF AGRICULTURAL CHEMISTRY AND ENGINEERING,
Washington, D. C., October 19, 1939.

HON. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith the report of the Bureau of Agricultural Chemistry and Engineering for the fiscal year ended June 30, 1939.

Sincerely yours,

HENRY G. KNIGHT, *Chief.*

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INTRODUCTION

This is the first annual report of the new Bureau of Agricultural Chemistry and Engineering. Previous reports on most of the lines of work mentioned herein were issued by the Bureau of Chemistry and Soils and the Bureau of Agricultural Engineering. In the reorganization of the Department of Agriculture which was effected early in the fiscal year 1939 the agricultural chemical research formerly carried on by the Bureau of Chemistry and Soils was combined with the agricultural engineering research formerly carried on by the Bureau of Agricultural Engineering. These two lines of research were placed under unified administration in the new Bureau of Agricultural Chemistry and Engineering, the purpose being to integrate these closely related activities in agricultural technology.

The consolidation also involved the transfer of work on soils, irrigation, and drainage to other Bureaus. The work relating to soils, formerly carried on in the Bureau of Chemistry and Soils by the Soil Survey Division, the Soil Chemistry and Physics Research Division, and the unit conducting research relative to plant mineral constituents derived from soils, was transferred to the Bureau of Plant Industry. That part of the work of the Divisions of Irrigation and Drainage in the former Bureau of Agricultural Engineering which relates to investigations, experiments, and demonstrations in connection with crop production on irrigable lands, the quality of irrigation water and its use by crops, and methods for improving and maintaining the productivity of irrigated soils, was transferred to the Bureau of Plant Industry. The remaining work of these divisions, which relates to investigations, experiments, and demonstrations in connection with the construction and hydrologic phases of farm irrigation and land drainage, was transferred to the Soil Conservation Service.

At the time the Bureau of Agricultural Chemistry and Engineering was created, it was authorized and directed to administer and operate the four regional research laboratories, established by the Department pursuant to the provisions of subsections (a) to (e), inclusive, of section 202 of the Agricultural Adjustment Act of 1938, for the purpose of developing new uses and wider industrial outlets for farm products and byproducts.

The organization of the Bureau of Agricultural Chemistry and Engineering consists of the offices of Chief, Associate Chief, Assistant Chief in Charge of Agricultural Engineering, Assistant Chief in Charge of Regional Research Laboratories, adviser in chemical research, business administration, information and editorial service, library, and the following research divisions and regional research laboratories: Carbohydrate Research, Fertilizer Research, Food Research, Industrial Farm Products Research, Protein and Nutrition Research, Naval Stores Research, Chemical Investigations of Allergens in Agricultural Products, Chemical Engineering Research, Mechanical Farm Equipment Research, Farm Structures Research, Farm Operating Efficiency Research, Rural Electrification Research, Mechanical Processing of Farm Products, Engineering Plans and Service, Northern Regional Research Laboratory (Peoria, Ill.), Southern Regional Research Laboratory (New Orleans, La.), Eastern Regional Research Laboratory (Wyndmoor, Pa.), and Western Regional Research Laboratory (Albany, Calif.).

The primary function of the Bureau's research is to promote agriculture by the acquisition and dissemination of scientific, technological, and engineering knowledge bearing on the following broad subjects: Production of fertilizer materials and mixtures; the improvement of farmhouses and other structures, farm mechanical equipment, farm operating efficiency, and mechanical processing of farm products; rural electrification; the prevention of farm fires and dust explosions; and the conservation and utilization of agricultural commodities and their products and byproducts.

The more important results of the work of the Bureau during the year are reported in the following pages. Further information concerning many of the subjects discussed may be obtained from the 310 publications issued by the Bureau during the year and listed at the end of this report together with a list of the 13 patents issued to members of the Bureau personnel.

FOOD RESEARCH

VEGETABLES AND VEGETABLE PRODUCTS

Research on vegetables and vegetable processing was continued in the branch laboratories in Florida, Texas, California, Oregon, and Washington, in cooperation with agricultural experiment stations and other State agencies, and with growers and packers. In addition, chemical and technological work on freezing vegetables was started, in collaboration with the Utah Agricultural Experiment Station. These investigations were concerned with the canning and manufacture of derived food products from vegetables that cannot be marketed in fresh form, the preservation of vegetables by quick freezing, the selection of the best varieties and strains of different vegetables for commercial production in particular localities for canning or freezing, methods for determining the proper stage of maturity for harvesting different vegetables, and methods for utilizing the byproducts of vegetable crops.

To insure continued growth of the frozen-foods industry, the products must be highly acceptable to consumers. Disappointment in a first purchase, or even in subsequent purchases, of frozen vegetables is likely to cause a loss of interest on the part of a prospective consumer. Not only must the vegetable be of prime quality to start with, but it must be so processed as to prevent, if possible, deteriorative changes due to enzyme action, oxidation, and drying during storage. Also, in order to prevent deterioration during storage and retard spoilage after thawing, the material must be handled in such a way as to inhibit any increase in the micro-organisms in the product, and preferably to reduce or destroy them. All vegetables are scalded or blanched with hot water or steam for a short time before freezing to inactivate enzymes.

Much experimental work was done to determine the proper temperature and time of blanching for different vegetables in order to inactivate enzymes without causing loss of flavor or other damage to the product. From these investigations it is evident that, if enzyme activity is to be used as a criterion of scalding conditions, the determinations must be placed upon a quantitative basis. Quantitative tests for catalase and phosphatase made on samples of asparagus used

in scalding experiments and the condition of the frozen product after storage indicated that these enzymes need not be completely inactivated before freezing. The action of proteolytic and lipolytic enzymes, as well as that of carboxylase, in asparagus is being investigated in relation to scalding practice and retention of quality. It is possible that the location of enzymes in the plant tissue should be considered in studies to determine what enzyme systems are responsible for deterioration in quality during storage. It was observed that the milk-clotting enzyme found in asparagus is completely inactivated after exposure for 60 seconds at 160° F., whereas catalase is still very active. It was assumed that this is due to the localization of the milk-clotting enzyme near the surface, in contrast to catalase, which is distributed throughout the tissue.

Some evidence was obtained that the off-flavors sometimes encountered in quick-frozen vegetables after storage may be due in part to changes in the proteins. Small quantities of soluble, noncoagulable nitrogenous material were found in frozen peas, decreasing gradually during the first 18 weeks of storage at 0° F. These quantities increased with higher temperatures and longer periods of blanching, indicating that more complete inactivation of proteolytic enzymes or the removal of considerably more soluble noncoagulable protein material resulted from the more drastic blanching treatments. It was observed, however, that high blanching temperatures in themselves have an adverse effect on the flavor of frozen peas.

Studies were carried out on the effect of freezing and subsequent storage on vegetables with known amounts of bacterial infection. The results may indicate desirable changes in the methods of freezing and storage. An investigation was started to determine the causes of darkening of frozen-pack vegetables, reported to take place more rapidly than in canned or fresh vegetables when the cooked products remain on the steam tables of restaurants. Since large quantities of frozen vegetables are sold to restaurants, hotels, and institutions, this darkening is an important economic factor.

Determinations were made of the microbial content of commercially frozen vegetables packed in 1938. Wide variations were found in the numbers of viable micro-organisms, not only in products from different plants, but also in different samples from the same plant. Since the number of surviving micro-organisms in frozen vegetables is affected by the length of the storage period, it would not be logical to establish "tolerances" based on cultural tests. A badly contaminated pack held in storage for a year or more might contain no more viable bacteria than well-handled produce held in freezing storage for only a few weeks. Accordingly, a direct bacteriological test for frozen-pack vegetables, similar to the Breed test for milk, one that will detect all bacteria, whether alive or dead, was investigated, with encouraging results. The chief advantage of such a test is that it would give precise information about the bacteriological content of the vegetables before freezing, thus indicating their sanitary history.

Work in cooperation with the Irrigation Branch Experiment Station at Prosser, Wash., to determine the adaptability for canning of several common vegetables grown under irrigation indicated that climatic and other conditions will probably prevent the development of an extensive vegetable-canning industry in the new irrigated areas. Peas grown

there were not suitable for canning, and green beans and tomatoes did not show satisfactory yields. Sweet corn and lima beans of satisfactory quality were produced, but the yields of the former were reduced by earworm infestation.

In cooperation with the branch of the Texas Agricultural Experiment Station (Substation 15) at Weslaco, Tex., tests were made to determine the relative value for freezing and canning of a number of varieties of different vegetables, particular attention being given to earworm-resistant varieties of sweet corn. Some of the experiments indicated that varieties of tomatoes adapted to the southern part of Texas are suitable for the manufacture of catsup, tomato sauce, and other tomato products, having excellent flavor and color.

Chemical and cooking tests of many varieties of peas and lima beans grown in various parts of California and preserved by freezing indicated that it will be necessary to select particular varieties for production in specified locations in order to obtain a frozen product with the most desirable qualities. As a result of previous work one variety of lima bean is being produced in increasing quantities for freezing preservation in southern California, the expected output for 1939 being a million pounds or more.

As a result of tests in cooperation with Washington State College and the Western Washington Experiment Station on the suitability of different varieties of vegetables for freezing preservation, lists of preferred varieties have been made up and are being distributed to prospective growers by the college and its extension service. Directions based on other experimental work were supplied to prospective growers and processors of asparagus in the Pacific Northwest. It was found that snap beans frozen in salt brine retained their bright-green color after cooking to a much greater degree than did those frozen without brine, and also had a softer texture after cooking than that of dry frozen beans.

Experiments in the utilization of overmature and crushed peas rejected by canneries indicated that such peas can be made into acceptable purees. High-protein feedstuffs were produced by drying several vegetable cannery wastes.

Much study was given to various proposed methods for determining the maturity of peas, including those based on specific gravity, proportions of different sizes, sugar content, and volume of juice that can be expressed. The first two were found to be useless; additional work remains to be done on the other two. In cooperation with the research committee of the Northwest Frozen Foods Association and a commercial canning company, several hundred samples of frozen peas for which tenderometer readings were available and representing six varieties of freezing-type peas were studied to determine the relationship between tenderometer values and the quality of the frozen and cooked products. This study revealed a very close correlation between the tenderometer values and the tenderness of the finished product. When methods of sampling have been standardized, the use of the tenderometer will have a definite and valuable place in the determination of raw grades.

The Seattle Frozen Pack Laboratory collaborated with the Northwest Frozen Food Association and the United States Bureau of Agricultural Economics in working out tentative standards for

grades of frozen peas. These standards were promulgated by the Department on May 25, 1939. Steps are now being taken toward the working out of grades for other frozen products, such as asparagus, through further cooperation with the interested parties. It is generally recognized that standards for frozen commodities are absolutely necessary for commercial success.

Continued investigations in cooperation with the North Carolina Agricultural Experiment Station on the manufacture of cucumber pickles under southern climatic conditions resulted in the production of dill pickles of good quality with respect to firmness and keeping quality. Lots of dills put up in 1-gallon cans and pasteurized at the conclusion of their fermentation in barrels were found after 10 months' storage to be firmer than unpasteurized lots. In experiments with various initial salt concentrations and rates of increase for the production of salt stock, the best results were obtained when the brine was initially 30-percent saturated and increased gradually to 70 percent in 6 weeks. With higher initial brine concentrations a larger number of hollow cucumbers or "bloaters" were obtained. Stock of somewhat inferior quality was obtained occasionally when the initial concentration was as low as 20-percent saturated. By whipping the surface of the brine at regular intervals, it was possible to control the mycoderma scum, which forms on the surface of the fermentation vats sheltered from sunlight and causes loss in brine acidity.

The gases evolved during cucumber fermentation were found by analysis to be mixtures of carbon dioxide and hydrogen. It was the first time that hydrogen had been demonstrated to be a product of cucumber fermentation. Twenty-two strains of hydrogen-producing organisms were isolated. Their activity was more pronounced in brines of higher salt content.

Work is in progress on the development of methods for the detection of organisms and products of organisms capable of softening salt stock, particularly the coordination of the plating method with the detection of enzyme activity on cucumber-stem sections, and on the determination and control of the different types of organisms that predominate in the different stages of fermentation.

CITRUS-FRUIT PRODUCTS

A number of citrus-fruit canneries in Florida have installed juice deaerators of an improved type invented by a member of the Bureau's staff. This type is more efficient than other deaerators in use and when properly operated will remove more than 90 percent of the dissolved oxygen in the juice, thus aiding in preserving the flavor and reducing the destruction of vitamins during subsequent processing and storage.

It is believed that some of the off-flavor that develops in canned orange juice during storage may be due to changes in the peel oil in the juice. This possibility is being investigated, and if peel oil in the juice is found to be responsible methods for its elimination will be developed. A method for accurately estimating the peel-oil content of citrus juices was demonstrated, and has been adopted by canners and juice graders.

Bacteriological examinations of canned citrus juices showed that, although flash pasteurization does not always yield a sterile juice,

the organisms that survive it will not multiply and cause spoilage in either orange or grapefruit juice.

Studies on orange oils produced in different localities in Florida showed that the failure of many of such oils to meet U. S. P. specifications is due to a lack of proper technical supervision, rather than to the inherent characteristics of the natural Florida oil.

In cooperation with the Florida Canners' Association and the Florida State Board of Health, studies were continued on the disposal of wastes from citrus-fruit canneries. A trickling filter was developed for promoting biological action on the wastes. This purifies them to the extent that they may be added to large bodies of water without destroying aquatic life. Work on the details of operating the process is nearly completed. Preliminary investigations at Weslaco, Tex., on the disposal of liquid waste from citrus-feed plants indicated that yeast fermentation may be an effective method of treatment. Continued existence of the cattle-feed industry utilizing solid citrus-cannery wastes will only be possible if the liquid waste can be satisfactorily disposed of. It is estimated that the production of citrus feeds, exclusive of their monetary value, results in an annual saving of about $2,000 per cannery, the cost of disposing of the wastes in other ways.

All the results of recent work on byproducts from citrus fruits have been combined in a revision of Department Circular 232, originally published in 1922.

APPLE PRODUCTS

Using methods based on the research of this Bureau, one apple growers' cooperative association in the Northwest started the commercial production of canned apple juice during the year. Blends of apple juice that are better than the juice from individual varieties were made by combining tart, sweet, and aromatic juices in desirable proportions. Modifications were made in the pectinase-enzyme clarification procedure for apple juice that helps to delay or prevent precipitation.

In a study on the availability of apple thinnings as a source of pectin, it was calculated from the weight of thinnings from selected trees that over 100,000 tons of thinnings are available each year in Washington alone. However, thinnings do not appear to be superior to present sources of pectin, such as apple pomace and citrus-fruit peel. Studies were made on the isolation of pectic substances from apples or apple pomace and the preparation of pectin derivatives. From these experiments, new ideas regarding the composition of pectin are being formulated.

Low-ash polygalacturonic acids were prepared by gentle saponification of apple pectin and treatment of the product with hydrochloric acid. A relatively cheap, simple, and practical method of making galacturonic acid by the enzymic hydrolysis of polygalacturonic acid was developed. As high as 85 percent of conversion was obtained. Improvements in the isolation and crystallization of galacturonic acid have resulted in increased yields and lower production costs. Since galacturonic acid has certain valuable therapeutic properties, the reduction in price from $2 or more to less than 10 cents per gram will permit greatly extended investigation of those properties and possibly

ultimate utilization of the acid by the medical profession. Samples have been supplied to research organizations in the hope of developing biological and pharmaceutical uses.

Studies were made on the oxidation of galacturonic acid to mucic acid in an effort to determine the possibility of using pectic substances as a source of mucic acid. Although galacturonic acid was oxidized almost quantitatively by nitric acid, its polymers, as they occur in pectic substances, were not. It appears, however, that acid hydrolysis of pectic substances prior to oxidation might make them available as a source of mucic acid.

MISCELLANEOUS FRUITS AND FRUIT PRODUCTS

As a result of cooperative work on the canning properties of new varieties of peaches and apricots developed by the Bureau of Plant Industry, several selections were recommended for trial in southern California. Commercial canners are adopting methods developed by the Pullman, Wash., laboratory for canning freestone peaches of varieties available in that section. The products have improved appearance and flavor and can be made from varieties of peaches only infrequently canned heretofore.

To provide outlets for surplus prunes in southern Idaho, methods of canning prunes of the available types and of producing prune butter and prune marmalade were developed. The products are highly acceptable and await commercial exploitation.

Continued growth of the fruit-juice industry, production of which increased from about 1 million cases in 1929 to 24 million cases in 1937, is dependent very largely on the quality of the product, which in turn rests largely on the methods employed, particularly those of pasteurization or sterilization. The ideal temperatures and times for flash pasteurization of juices from several fruits were determined at the cooperative laboratory in Geneva, N. Y. Studies were also made of ways for removing oxygen, which in the finished products causes discoloration and precipitation. Blending juices from different varieties of the same fruit and those from different fruits resulted in more palatable flavors. Such blending also makes possible the sale of mixed products from expensive and cheaper fruits at prices that will promote an expansion of sales volume.

Frozen marmalade bases were prepared from sweet and sour cherries. Pectin and part of the necessary sugar were added to some of these at the time of freezing so that by adding sugar in the amount of half the weight of the base and cooking for a short time a satisfactory marmalade may be obtained.

The pack of frozen fruit pulps in 1939 was expected to be three or four times as large as that in 1938. Frozen crushed fruits produced as toppings for sundaes are meeting with hearty approval, and commercial production is rapidly expanding both in quantity and the number of fruits treated. New types of fruit confections, based on products developed in the laboratory, are being produced commercially in California. These consist of frozen fruit pulp in bar form, coated with chocolate, and combined layers of vanilla ice cream and frozen fruit pulp. They are frozen on sticks and sold by vendors at 5 cents each. The products are of real value from a

dietetic standpoint, and in addition furnish an outlet for large quantities of fruit that cannot be sold in fresh form.

Experiments to determine the relative value of different varieties and strains of fruits for quick freezing, in cooperation with the Irrigation Branch Experiment Station of Washington, resulted in the selection of certain varieties for further experimentation, with the view of commercial production. Frozen products were prepared from strawberries, raspberries, blackberries, Logan blackberries, apricots, plums, and peaches for use as desserts, sundae toppings, and fruit-flavor bases. Many of the products were highly satisfactory, although all plums tested showed the characteristic skin toughness and bitterness that is yet an unsolved problem of frozen-pack plums.

An unsuccessful attempt was made to develop a method based on the use of X-rays and a fluorograph for detecting the abnormal tissue in so-called chalky or hard-end Bartlett pears in sorting pears intended for canning.

CEREALS AND SEED PRODUCTS

BAKING INVESTIGATIONS

Appetizing and nutritious cookies were made from mixtures of whole wheat, peanut, and soybean flours in various proportions. Such cookies contain less starch and considerably more good-quality protein, minerals, and vitamins than do ordinary cookies. For this reason they are a better balanced food product and should prove especially desirable to that large portion of the population whose diet is for the most part deficient in protein, minerals, and vitamins.

The best temperature for long-time storage of compressed yeast was found to be 30° F. At lower and higher temperatures the yeast did not keep so well. Packing yeast in solid carbon dioxide previous to storage was found to result in subsequent deterioration.

Irradiation of wheat flour with ultraviolet light for as long as 16 hours had an adverse effect on the quality of gluten and the baking quality of the flour.

It was found that the addition of a water extract (of several hours' standing) of wheat germ to flour resulted in marked improvement in the quality of bread. Such an extract was high in diastatic power. The bread produced with the germ extract was better than that obtained when the wheat germ as such was used.

STALING OF BREAD

Studies on the staling of bakery products indicated that staling of bread is directly connected with the exchange of moisture between crumb and crust. When freshly baked bread is placed in a cabinet maintained at constant temperature and at such degree of humidity that the entire loaf neither gains nor loses in weight, the crumb, with an original moisture content of about 45 percent, loses nearly 10 percent of its moisture in 3 days, while the moisture content of the crust, originally about 20 percent, increases to about 30 percent. Addition of a small quantity of sweetpotato flour (8 to 10 percent) to wheat flour produces bread of better keeping quality than that of bread from wheat flour alone. The use of canned orange juice in bread

making (up to 5 percent of the weight of the flour) also produces bread which stales less quickly than does ordinary bread.

RANCIDITY OF VEGETABLE OILS

Studies on the effects of light transmitted by various light filters on the development of rancidity in oils yielded further evidence that the light energy of the ultraviolet, violet, and blue spectral regions, rather than light intensity alone, promotes rancidity. The speed of the photochemical reaction that induces rancidity increases with the light intensity of this particular region. A sextant red filter, which transmits many times the total energy transmitted by sextant green, inhibits the development of rancidity apparently as well as does the green filter because the sextant red transmits no energy in the ultraviolet, violet, and blue regions.

A physicochemical test has been developed for following the autoxidation of an oil or fat. This eliminates the personal equation characteristic of organoleptic tests. This test indicates the progressive changes that take place from the beginning of oxidation up to and beyond the point where rancidity is recognized by taste or smell. In this test a quantity of the oil under observation is added gradually to a definite amount of magnesium chlorophyll until the mixture when observed under an ultraviolet lamp equipped for fluorescence studies shows that the red fluorescence is quenched. The quantity of oil added is called the chlorophyll value. The greater the quantity of oil required to quench the red flourescence, the higher is the chlorophyll value and the nearer rancidity. Work is being done to establish, if possible, the chlorophyll value that corresponds with organoleptic rancidity.

COMPOSITION OF WILD RICE

In collaboration with the Bureau of Plant Industry, the composition of wild rice was studied. This study was conducted as a project under the Bankhead-Jones Act of June 29, 1935, providing for basic research in agriculture. It is said that many thousands of Indians in the North Central States are dependent in part for a living on gathering and trafficking in wild rice, for which special dietary qualities are claimed. Parched wild rice forms an important part of the diet of these Indians, and this product is becoming popular even in localities far distant from the places of origin. Data regarding the composition and food value of wild rice were needed to determine the merits of a proposed program for improving this commodity through breeding, selection, and cultural methods.

The average results of analyses on hull-free samples of wild rice gathered from about a dozen localities in Minnesota were as follows, expressed in percent on a water-free basis: Ether extract (fat), 0.93; crude fiber, 1.22; ash, 1.72; protein, 16.30; sugar, 2.14; nitrogen-free extract, 77.69. Thus, wild rice grown in Minnesota is richer in protein than are the common cereals. In mineral and sugar content it resembles wheat. Wild rice has about the same amount of fiber and fat as so-called brown rice. The average results of analyses on corresponding samples after parching showed a decided loss in the sugar content and appreciable losses in ash, crude fiber, fat, and protein contents. Parched rice from which little or no bran was removed in the process

of removing the hulls was higher in protein, minerals, and vitamin B than the samples from which much of the bran was removed. Hence, the former has appreciably greater food value than the latter. This fact may be of significance in cases where wild rice forms a large portion of the diet. Parching, in a sense a roasting process, is a necessary step preliminary to the removal of the hulls, and it adds flavor to the product.

EGGS AND EGG PRODUCTS

The method recently developed by the Bureau for checking the accuracy of egg-grading practices by measuring the surface of broken-out egg white with special apparatus has been applied commercially. It was found that, because of shaking, eggs lose candling grade when subjected to frequent candling, although the true quality remains unchanged. Furthermore, when seller and buyer have eggs candled before and after delivery, the buyer may find his eggs of lower grade than he expected, although the candling was correctly done in both instances. Ignorance of this fact must have led to many disputes. If the eggs are allowed to rest after handling, the effect of the shaking on the position of the yolk gradually disappears, but this may take a week or more.

A quick method was developed for estimating the quantity of oil in the shells of oiled eggs. This is suitable for commercial use in determining whether or not the oiling is being done properly. A study of the protein responsible for the gel structure of egg white brought out interesting facts concerning ovomucin, some of which may be connected with the natural deterioration of shell eggs. This study is not yet completed.

Experiments were started to determine the relative keeping qualities of frozen eggs produced at different seasons. These were suggested by the knowledge that egg whites contain a substance called lysozyme, which is capable of dissolving certain types of bacteria and which, from previous work, appeared to vary in quality or activity at different seasons of the year. Further work is needed to demonstrate the effects of freezing and freezing storage on the activity of lysozyme in eggs, particularly its specificity for the types of organisms that cause food spoilage and food poisoning.

ENZYME INVESTIGATIONS

Further studies were made on the proteinase of wheat. The crude enzyme separated from bran was purified and concentrated about eightfold by a combination of protein precipitations and adsorption on alumina. The reactions of the purified enzyme corresponded to those characteristic of papainases, and thus the enzyme appears to have been definitely identified. However, in view of the objection raised outside the Department that the enzyme from whole wheat might not be responsible for the behavior of white flour and, therefore, that the simple explanation of the action of oxidative bread improvers might not hold, an investigation was made of the enzyme in white flour. By means of salt extractions a surprisingly large quantity of enzyme was separated from patent flour. After the enzyme was slightly purified, it was tested and found to have the same essential character as that separated from bran. No differ-

ences have been noted thus far. Both bran and flour proteinase preparations are stable in salt solutions but not very stable in water.

A study of the proteinase of lima beans was completed, and the results were published.

It was hoped to observe the enzyme activity in flour made from dead wheat, but attempts to kill wheat by exposure to oxygen and carbon dioxide were not successful. The question is important because dead wheat does not make good flour, and if wheat is stored a long time, a certain amount of loss from death must be reckoned with unless the factor connected with the loss of baking quality can be supplied artificially. For similar reasons the enzymic behavior of pulverized patent flour was studied. It was found, however, that powdering the flour does not affect the proteolytic enzyme particularly, so that the loss in baking quality always shown by pulverized flour appears to be due to a change in the proteins rather than to a specific loss of proteolytic enzyme.

In the study of cereals and other seeds, it was noted that only wheat, rye, barley, and soybeans contain appreciable quantities of free amylase (set free in water) and of total amylase (set free in the presence of papain). Oats, rice, corn, sorghum grain, buckwheat, and cowpeas contain relatively small quantities of this enzyme. The amylase of wheat is set free not only by papain but also by lactic acid, sodium chloride, yeast, and bacteria. The liberation of amylase of barley was inhibited by lactic acid and yeast, but was not affected by sodium chloride. Rye amylase was not affected by lactic acid, sodium chloride, yeast, or bacterial activity. Ordinary white flour was found to be about as rich as whole wheat in total amylase, but it was much poorer than whole wheat in free amylase, probably owing to the fact that the papainlike substances naturally present in wheat are more concentrated in the germ and bran. It was found also that in doughs prepared from ordinary white flour by a standard procedure the free amylase content is practically equal to the total amylase content of the flour and that both the yeast and the common salt in the quantities used for baking bread have the power of liberating the amylase present.

While the role of seed amylase in human nutrition is not yet known, it seems significant that since ancient times the human race has selected for bread and breadlike purposes the three seeds—wheat, rye, and barley—that are comparatively rich in amylase.

The work on papain, which enzyme was previously prepared by the Bureau in crystalline form, contributed much toward the solution of other enzyme problems, particularly those relating to proteolytic enzymes in wheat, lima beans, and muscle. As a result of collaborative work with the Hawaiian Agricultural Experiment Station, papain was prepared that is better than any on the market. In ordinary commercial preparations, at least half the enzyme activity is lost. Preparations made experimentally in the laboratory are about one-third stronger, but it is still uncertain how long they will keep.

Studies of enzyme action at low temperatures were continued as a project under the Bankhead-Jones Act. It was found that the protein-splitting enzyme in beef works slowly but quite definitely on the meat proteins in cold storage. When the quantity of this enzyme normally present in meat was increased by introducing some of the

isolated enzyme, marked digestion occurred, but the action was slowed down greatly at low temperatures. The advisability of using colder warehouses for meat storage is thus apparent. The ester-splitting enzyme in muscle, mentioned in last year's report, was studied in more detail in beef tissue. It was finally prepared in solution, free from all organized tissue, by extraction of washed muscle with either alkali or digitonin. It does not attack unsaturated higher fats, but confines its action exclusively to lower fats and esters of lower fat acids. The enzyme is to be regarded as a typical esterase rather than a lipase, as shown by an investigation of lipase from the pancreas. It does not appear to be of very great significance in the deterioration of meat, but may play an important part in the decomposition of butter, the fat of which is very susceptible to attack by this ferment. Its function in muscle is probably metabolic, rather than catabolic. Discovery of the fact that a synthetic ester, benzyl butyrate, is split by this enzyme with greater rapidity than are the natural esters has permitted a more rapid and delicate test to be made. Since the butyric acid may be removed by distillation, the presence of nonvolatile fat acids in the tissue does not complicate the result.

Considerations of the thermodynamics of the action of enzymes at low temperatures led to the conclusion that although the reactions become slower as the temperature is decreased, the relative ease of decomposition by enzymes is greater than that of other chemical reactions and that caused by micro-organisms. Unfortunately, since enzymes are integral parts of the original product, there is no way of removing them without destroying the commodity.

PHYTOCHEMICAL INVESTIGATIONS

Fundamental research was continued on the composition and properties of naturally occurring fat acid glycerides. In this investigation molecular distillation methods and equipment were used for isolating the compounds without alteration or decomposition. Very few oils and fats have been exhaustively examined with respect to their various components as they actually exist in the plant. More definite knowledge as to the identity and composition of the various glycerides of oils and fats in their natural condition should prove useful in solving problems relating to the breeding of oil-producing plants, the deterioration in storage of oils and fats and foods containing them, and the digestion and assimilation of oils and fats by animals.

Equipment for cyclic molecular distillation was installed and used in preliminary purification work. Cottonseed oil of Prime Summer Yellow grade was distilled, with indications of appreciable fractionation. Successive fractions, consisting essentially of the glycerides of the oil, showed a steady increase in iodine number from 96.5 to 120.8 and in refractive index from 1.4632 to 1.4661. The yellow color showed a definite tendency to concentrate in the early fractions, the later ones being almost colorless, while the undistilled residue had considerable color of a dirty-greenish cast.

A study of α and β linoleic acids and of their bromination and alkaline permanganate oxidation products led to the conclusion that α, β, and natural linoleic acids are identical and have but one geometrical configuration.

Work was continued on the preparation and study of pure unsaturated fat acids and their glycerides, especially oleic and β linoleic acids, triolein and trilinolein. These compounds are needed in future work involving more detailed molecular distillation studies. Highly purified methyl oleate was prepared successfully. Syntheses of triolein and trilinolein were carried out by esterifying the corresponding fat acids and glycerine in an atmosphere of nitrogen and using paratoluenesulfonic acid as a catalyst. The products were partly purified by low-temperature crystallization from acetone. Final purification was accomplished in the Hickman cyclic molecular still without any evidence of polymerization or decomposition. Triolein prepared in this manner yielded a theoretical iodine number. Work is in progress on the preparation of pure glycerides in quantities sufficient for further study.

The flavor of Montmorency cherry juice was found to be due mainly to benzaldehyde, with a trace of geraniol. One-third of an ounce of a mixture of about 35 percent of methyl alcohol and 65 percent of ethyl alcohol was separated from 25 gallons of the cherry juice. The nonvolatile acids consist chiefly of malic acid with a very small amount of citric acid. A study of the flavoring constituents of red raspberries is in progress.

At the request of the Hillculture Division of the Soil Conservation Service one gum-bearing and eight saponin-bearing plants were examined with the object of determining their commercial possibilities.

PHARMACOLOGICAL INVESTIGATIONS

The last four of a series of eight papers reporting the results of studies on phenothiazine, the insecticidal material found to have therapeutic value as a urinary antiseptic, were published during the year. The widespread interest in this side-line investigation on phenothiazine was indicated by the large number of requests for information and reprints received from physicians. Experiments were started, in cooperation with Stanford University School of Medicine, to determine the possible value of phenothiazine and its oxidation product, thionol, for the treatment of trichinosis. Upon investigating the cause of dermatitis or sunburn suffered by a number of orchard workers after applying phenothiazine as an insecticidal spray, it was found that although phenothiazine applied to the skin protects the underlying tissues from sunburn, the compound taken internally sensitizes the body to the action of ultraviolet light, so that what would ordinarily be a minor burn becomes one of greater magnitude. The sensitization of the orchard workers probably resulted from inhaling some of the spray.

In further studies on the chronic toxicity of cadmium, it was observed that the incisor teeth of rats eating the cadmium-containing diets were white instead of the usual brown. Since fluorine bleaches rat incisors and was present in subminimal amounts in the food given to the rats, the question arose as to whether the cadmium itself produced the bleaching or whether it promoted the action of fluorine. This question has not been answered definitely, but it appears that the cadmium itself causes bleaching and that the actions of cadmium and fluorine are additive. The fact that cadmium acts similarly to fluorine in this respect suggests the possibility that other substances

may do the same. The question is important in studies of fluorine toxicosis by examination of teeth in areas of endemic mottled enamel. During the study on the mechanism of cadmium-bleaching of incisors, it was found that thyroid administration very markedly increased the degree of fluorine bleaching. It is important, therefore, to determine whether in areas of endemic mottled enamel hyperthyroid individuals are the most affected. If so, it has an important bearing on tolerance limits for fluorine insecticides on food products and raises the question of whether the public health should be protected by tolerance limits aimed to protect the hypothyroid, hyperthyroid, or normal individual.

Preparatory to determining the distribution of antimony in the various organs of the rats fed on antimony-containing diets, a colorimetric method suitable for the determination of very small quantities of antimony in the absence of sulfates was developed. This method must still be tested for its applicability to the analysis of tissue digests. A study is in progress on the effect of continued ingestion of antimony-containing diets on fertility and reproduction in rats.

Investigations were started on the pharmacological effects of organic compounds proposed for use as insecticides, including 2-acetaminofluorene, pentaerythrityl bromide, azobenzene, and dimethylacridan. It was found that all these compounds are capable of inhibiting growth and that azobenzene and dimethylacridan produce blood injury, but further work is necessary to establish the critical dosage level for each of these substances.

PLANT VIRUSES

In cooperation with the Bureau of Plant Industry chemical studies were continued on tobacco-mosaic virus as a basic research project under the Bankhead-Jones Act. The problems were approached on the assumption that this virus is a complex dissociable nucleoprotein. By using a method of measuring the quantity of virus protein in the tissues of the plant, based on the previous finding that proteolytic enzymes do not digest this virus, it was possible to correlate the disease with the production of abnormal protein and to observe the variation between ordinary and relatively immune plants. The rate of production of virus protein was found to be more rapid initially than was previously supposed. Virus protein was not produced entirely, if at all, at the expense of previously synthesized normal protein. The quantity was highest in growing tissues, and decreased in amount as the infected plant grew old, with almost complete disappearance in more resistant plants. The results of the experiments provide a foundation for the investigation of any connection that may exist between metabolic processes and the elaboration of abnormal protein in susceptible plants.

The virus protein was found to dissociate under the influence of urea and similar substances, thereby becoming digestible by proteolytic enzymes. Reassociation occurred, however, on removal of the reagent. Ultraviolet light did not affect the digestibility, but destroyed the activity of the protein as a virus. Digestibility and virus activity, therefore, are not related.

The size of the particles of two strains of tobacco-mosaic virus were of the same order of magnitude, as shown by the results of

sedimentation experiments in the ultracentrifuge. Dielectric measurements showed that these particles behave electrically like colloidal aggregates rather than free molecules.

ANIMAL VIRUSES

Chemical studies on animal viruses and the proteins of tumors were started during the year as a basic research project under the Bankhead-Jones Act, the object being to study one or more of the tumor-producing agents on the hypothesis that they are susceptible to straight chemical investigation. Soluble preparations of rabbit myxoma of great potency were made from the tumors, and the investigation of these preparations is now under way. Because of the great complexity of the system and the long time required for each test, the results obtained so far are insufficient for publication.

PRESERVING BIOLOGICAL SPECIMENS

The investigation of processes for preserving botanical and entomological specimens in as nearly natural condition as possible was continued as a basic research project under the Bankhead-Jones Act. Well-preserved biological specimens are needed in scientific research, as permanent records of healthy and abnormal conditions and for exhibition or educational purposes. Improvements were made in both the interrelated processes mentioned in last year's report.

One of these processes consists essentially in chemically treating fresh plant materials to toughen the tissues and set the natural color, after which the specimens are flattened, dried, and mounted on glass or between transparent cellulose films. The technique for the preservation of the natural color of specimens has been simplified and improved so as to extend the scope of the method and increase its practicability. The use of lower temperatures during the first stage of treatment has made possible the application of the preserving process to certain fruits and thick succulent plant tissues. Other improvements have been made in the various steps of the general process, in the treating formulas, and in the types of mounting. Such improvements have permitted the preparation, with sufficient fidelity for record purposes, of many specimens, including leaves, vines, fruits, and flowers. Particular attention was given to the preservation of pathological material, and interesting results were obtained in showing as permanent records the appearance of insect pests and plant parasites and their relationship to the plant hosts.

The other process permits the specimen to be encased intact, or without distortion, in a solid, nearly colorless, and transparent plastic. Its essential features are dehydrating the specimen, mounting in prepolymerized liquid methacrylate plastic, removing the air, completing the polymerization at proper temperatures, and finally heat-treating to prevent or minimize "crazing." After machining, the mounts can be polished to a high luster. The mounted specimens, which are exceptionally pleasing in appearance because of the unusual brilliance and transparency of the plastic, may be viewed from any angle, and are light in weight and unbreakable. This method makes it possible to keep specimens indefinitely, with complete preservation of their shape, size, and natural color. The method of embedding has been improved with respect to elimination of cloudiness, formation of bubbles, and extraction of color from the specimens by the

liquid plastic. A treatment has been devised that should prevent or greatly minimize crazing.

A number of unusually valuable and rare botanical specimens have been preserved by both methods in order to retain them as permanent records in their original color and shape. These and numerous other specimens prepared by both methods have attracted considerable attention and elicited much favorable comment. However, there are a number of difficulties to be overcome before the methods can be released for general use.

WALNUTS

The method devised by the Bureau for facilitating the removal of hulls from sticktight walnuts by treatment with ethylene is in almost universal use in the inland valleys of California, where high temperatures prevail during harvest time. The quality of the walnuts, as determined by the color of the kernels, is improved and therefore the return to the grower is materially increased by the process.

CARBOHYDRATE RESEARCH

SUGARCANE AND CANE SUGAR

Analyses of raw and clarified juices from six varieties of sugarcane, and of the muds removed during clarification with lime and heat at low, medium, and high hydrogen-ion concentration, indicated that the substances principally affecting the rise in purity during clarification are phosphates and proteins, although silica and other substances are also important at times. At a given pH value the increase in purity obtained is governed by the proportions of these precipitable materials in the raw juice and is little affected by differences in the method of clarification. While ash content is generally reduced by clarification, the actual salt content increases, since the removal of silica and bases is usually more than balanced by the increase in lime. Decrease of ash is partly due to the substitution of organic acid radicals for the phosphate ions precipitated. The increase of lime in the ash of the juice after clarification appears to be related to the content of nonprotein nitrogen in the juice. The color of juices and sirups is associated not only with iron content but also with lime and nitrogen.

Low ash content was found to be a consistent characteristic of the juices from varieties C. P. 28–19 and C. P. 29–116, and low nitrogen content was characteristic of juices from varieties Co. 290 and C. P. 29–116. Variety C. P. 28–11 was high in both ash and nitrogen. It seemed probable that the comparatively high nitrogen content of the varieties Co. 281, C. P. 28–11, and C. P. 28–19 limits their production, since generally low tonnages are obtained per acre. When fertilized with nitrogen compounds these varieties increased less in tonnage and more in nitrogen content than did such varieties as Co. 290 and C. P. 29–116, which are low in nitrogen. Differences in ash content seemed to be associated more with potash and sulfate content than with variation in all constituents.

Study of the clarification of juice from cane stored under different conditions indicated an improvement when the cane dries out and a small adverse effect when the cane is kept moist.

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To evaluate a sugarcane for sugar production, the fiber and normal juice content must be considered as well as the analysis of the expressed juice. By direct determination, the fiber content of the most common commercial varieties of Louisiana cane was found to range from 10 to 16 percent. Leaving cut cane on the ground for 9 days before grinding was found to increase the fiber content by about 2 percent, based on the weight of the cane. The advantages of low-fiber cane, when accompanied by low sucrose content and low purity, as in the case of Co. 290 and C. P. 29–116, are offset by the much greater volume of water that must be evaporated for 100 pounds of sugar produced.

In cooperation with the Bureau of Plant Industry, the keeping qualities of additional new seedling varieties of sugarcane were determined. A number of seedling varieties were found to be superior in keeping qualities to some varieties being grown commercially. From the standpoint of keeping quality, Co. 281 is superior to all the other varieties in commercial production, and this is the only variety fully recommended at present for windrowing or storing.

It was found that the degree of damage sustained by cane during a freeze may be estimated by a chemical test on juice from cane that has been stored at 80° F. at high humidity for as little as 24 hours. This test will supplement physical examination of the cane and distinguish between degrees of damage that lead to fermentation and those that do not. Two types of fermentation may occur in frozen cane, depending largely on weather conditions following the freeze. One is a simple alcoholic fermentation that causes considerable loss in sucrose but no operating difficulties in the sugar factory. The other is a dextran-acid type of fermentation that causes a great deal of trouble in the factory because of the high viscosity resulting from the dextran gum. A study of the dextran and the true and apparent sucrose contents of sugar-house products from frozen cane showed the surprisingly low dextran content of 0.4 to 0.5 percent, based on solids. The true sucrose content of these products was found to be lower than the apparent sucrose, indicating that false apparent purity is partly involved in the difficulty in exhausting molasses from deteriorated juices. Results of an investigation on the micro-organisms isolated from frost-damaged sugarcane and their fermentation products when grown in culture media were published.

Sugarcane in Louisiana was subjected to rather severe freezing temperatures during 4 nights between November 25 and December 1 in the past season. From studies made on the cane following these freezes, it was evident that sugarcane chilled below 32° F. but above actual damaging temperatures (about 25° F.) keeps as well or better in the windrow than cane windrowed before the freeze. At least for 2 weeks, in most localities, the alcoholic fermentation predominated over the dextran-acid type of fermentation ordinarily experienced. As a result, at most factories operations continued without difficulties under these conditions. Except to protect the crop from further freezing damage, there is little gained in windrowing cane that has been injured to the point of fermenting. When standing cane is frozen, the top of the stalk is likely to be most seriously injured and to deteriorate most rapidly. Topping back, therefore, is a help but prevents only part of the factory difficulties in working up frozen

cane because excess acidity and gums develop in all sections of the cane.

The external wax of sugarcane was found to vary widely in quantity between different varieties and to some extent between the eastern and western sections of the Louisiana sugarcane belt. It was highest in varieties Co. 290 and C. P. 28–19, averaging about 1.5 pounds per ton of cane, and was very low in C. P. 29–116, which contained only 0.2 pound per ton. This wax has possible commercial value because of its high melting point. The content of internal fats and waxes in sugarcane was found to be relatively uniform in all varieties and locations.

In experiments to determine the possibility of producing a cheap carbon from some of the byproducts of sugar manufacture, it was found that carbon comparing very favorably with the commercial grades of activated carbon when tested on refinery melt solution could be made without the use of impregnating substances.

Hydrogen peroxide was found to be effective for reducing sulfite flavor and odor of oversulfured sirups and molasses.

BEET SUGAR

Investigation of the various factors that influence composition of sugar beets and quality of beet sugar was continued. The Bureau's annual report to the industry stressed the influence on quality of certain variations in production processes and suggested certain improvements to increase efficiency. The introduction of a technical grading formula for sugars has permitted correlation of factory data, thereby establishing the fact that optimum purity of white masecuites is probably much lower than that practiced by a number of factories. This has enabled certain factories to lower their purities and save much costly remelting, without detriment to sugar quality. It is hoped that even greater aggregate savings may accrue to a larger number of factories that had previously contemplated equipping for production of high-purity massecuites. A single, high-purity raw-sugar boiling system was designed to replace a high- and low-purity raw-sugar boiling system. Besides making possible fuel economy and improvement in sugar quality, this system lends itself to further improvements in the refining process.

A survey and study of disposal of waste water by beet-sugar plants, in relation to stream pollution, was begun, and a tentative solution to a pressing situation at one particular factory was found. The recent introduction of multiple-effect pressure evaporation into the beet-sugar factory indicates the possible solution of the disposal of Steffen waste water. At a fixed power demand, from eightfold to tenfold evaporation is possible instead of fivefold, as previously obtained, thus permitting low-cost concentration and recovery of materials contained in the waste water for commercial utilization.

FARM-MADE SIRUPS

The small-scale production of sugarcane and sorgo sirups in many sections of the country fits well into the program of diverting land from the production of major crops to prevent surpluses and feeding farm families so far as possible from their own land. Each year more and more farmers are attempting to make a start in sirup pro-

duction. Although much of the farm-made sirups is utilized to good advantage at home, many of the more ambitious sirup producers are endeavoring to make sirup a somewhat larger cash crop. In order to sell readily the products must be of uniformly high quality. Good quality is also important in farm-made sirups used at home.

The presence of sediment in farm-made sirups is a serious defect in quality. Investigation of the factors involved in causing such sediment was transferred to the Auburn, Ala., station, where the laboratory has been equipped for a comprehensive study of this problem. Preliminary work was done on the development of a simple photoelectric method for measuring the color and turbidity of sirups, on the composition of sirup sediments, on the use of protective colloids and salts for preventing the separation of sediment, and on the refining of sirups by clarifying and centrifuging.

Cooperation was continued with a number of agencies active in putting the results of the Bureau's sirup investigations into farm-scale and commercial practice. The Bureau supplied technical assistance in the construction and operation of a farmers' cooperative steam plant for sugarcane sirup at Poplarville, Miss., and likewise assisted in the operation of several other plants of less capacity. Cooperation with the Alabama Extension Service specialist on sirups and sirup crops was continued, special attention being given to a new steam plant at Evergreen, Ala. The Alabama specialist has made rapid progress in the sirup work in his State. Cooperative work on sorgo sirup was begun at the Georgia Experiment Station.

At Meridian, Miss., a comprehensive study was made of the variation in sucrose, dextrose, and levulose contents of numerous varieties of sorgo and sugarcane-sorgo hybrids in relation to various factors such as degree of maturity, varietal characteristics, and location in various parts of the plant. The data, which are the most extensive so far obtained for these plants, have an important bearing on physiological functions and evaluation of these plants for sirups and sugar production. The most promising varieties were selected for further investigation. Nineteen varieties had a sucrose content above that for standard sugarcane now in use by the domestic sugar industry. The investigation indicated that harvesting at the proper degree of maturity for a given variety is often a practical and effective means for preventing crystallization or sugaring of the farm-made sirup.

Maple sirup grading standards were prepared for the Bureau of Agricultural Economics, and additional sets of master standards were supplied to the States that use them in connection with the preparation of larger quantities for State distribution. New turbidity grading standards were also supplied. The use of permanent glass standards was further investigated.

HONEY

Investigations were continued on the chemical and physical properties of honeys of various floral types for the purpose of more definitely evaluating the characteristics of these types and their suitability for various uses. Particular attention was given to granulation (dextrose crystallization), as influenced by the solubility rela-

tionship of dextrose and levulose, and to viscosity in relation to hygroscopicity. Results to date indicate that existing data on the solubility relationship of dextrose-levulose mixtures do not exactly apply to honey and similar sugar products of equally high density. The data throw more light on the crystallization process and will be of value in devising improved methods of processing and handling honey commercially.

Although it was expected that honey of the highest levulose content would be the most hygroscopic, since levulose is known to be more hygroscopic than dextrose, it was found that tupelo honey, which contains more than the average proportion of levulose, was actually less hygroscopic than some other honeys of lower levulose-dextrose ratio but of higher viscosity. It was concluded, tentatively, that a higher degree of hygroscopicity in honey is more closely correlated with composition factors causing high viscosity than with the percentage of levulose in the honey. Hygroscopicity, in the sense of ability to retain moisture, is an important property of honey in relation to commercial uses, and a better understanding of the hygroscopic properties of honeys of different floral types will undoubtedly lead to its more extended use for certain purposes, thus opening up some new markets.

STARCHES

Further technical assistance was given to the farmers' cooperative sweetpotato-starch plant at Laurel, Miss., which during the 1938 season processed about 165,000 bushels of sweetpotatoes to produce 1,700,000 pounds of commercial starch. The rated capacity of the plant (10 tons of starch per day) was nearly doubled, with consequent lowering of manufacturing costs, by the introduction of minor mechanical changes that permitted more rapid drying of the starch. The outlook for the 1939 season was most favorable, and production was expected to reach the maximum season's capacity of the factory operating at its increased rate. Sweetpotato starch was found to offer distinct advantages in the baking and confectionery industries. The textile and laundry industries are continuing to use sweetpotato starch with success.

A new and rapid polariscopic method was developed for the determination of starch in sweetpotatoes and starch-factory products, and was used for control work at the Laurel starch plant with satisfactory results. A study in cooperation with the Food Research Division indicated a means of controlling micro-organisms capable of causing fermentation in starch-bearing factory liquors in warm weather. Investigation indicated that starch finished at pH 6.0 to 8.0 is the most stable during storage.

A process designed to recover sweetpotato solubles and to simplify the starch-extraction process in small commercial plants was developed on a laboratory scale. Pilot-plant dehydration studies were started in connection with the problem of storing sweetpotatoes for continuous operation of a starch plant. The process used consists of a preliminary chemical treatment of the ground sweetpotatoes, removal of a large proportion of the water by pressing or centrifuging, and final drying with heat. Lime was found to be as effec-

tive as sulfur dioxide or carbon tetrachloride for facilitating removal of juice by mechanical means. The use of lime is advantageous because lime is cheap and, being noncorrosive to iron, it makes unnecessary the employment of more expensive metals for equipment. A number of different types of commercial presses and centrifuges were tried out to determine their relative worth for dewatering ground sweetpotatoes. It is believed that there will be a rapid expansion in the sweetpotato-starch industry in the South if successful methods of storing raw material and recovering additional byproducts can be found.

It has long been realized that the success of a sweetpotato-starch industry is largely dependent on growing the crop cheaply. Experiments with small-scale equipment now in use for harvesting sweetpotatoes resulted in mechanical improvements and in great saving of time for picking up sweetpotatoes and transferring them to trucks. Equipment to remove vines from potato rows, to be used in connection with large-scale harvesters, is being developed. Large-scale growing operations were investigated, beginning with the preparation of the seedbed and proper placement of plants to insure favorable conditions for use of a harvesting machine (combination digger and loader, as used for white potatoes). Experiments were also made on reduction in number of plants per acre, different planting patterns, and fertilizer placement. This investigation, which is conducted in cooperation with the Mississippi Agricultural Experiment Station and the Division of Mechanical Equipment of this Bureau, is expected to result in far-reaching changes in the agronomic handling of the sweetpotato crop.

MISCELLANEOUS CARBOHYDRATES

In the study of miscellaneous carbohydrates, particular attention was given to the hemicelluloses. The chemical nature and physiological function of this group of carbohydrates are less understood than those of cellulose, sugars, and starches. Relatively little industrial use has been made of the hemicelluloses, one of the principal applications being the use of pectin in jellies. Hemicelluloses are known to be an important factor in the feeding value of many crops, but the exact function is little understood. Increased knowledge of the character and properties of hemicelluloses is expected to lead to their more effective use and to important developments in plant culture. Preliminary to other studies, satisfactory methods must be developed for the extraction, separation, and identification of the various constituents of hemicelluloses.

Work on the various methods for the extraction of hemicelluloses from plant materials was concluded, and the results were published. Variations in such factors as acidity, alkalinity, and temperature of extracting media were investigated with the object of ascertaining the optimum conditions for extracting hemicelluloses. It was found that the optimum conditions are different for the various materials studied, which included sugar-beet pulp, peanut shells, rice hulls, and sweetpotato pulp, and that the presence of pectin has a decidedly retarding effect on extraction.

In cooperation with the Food Research Division, an attempt was made to separate hemicelluloses from plant materials by selective bacterial action on the cellulose present. So far, the results have not been decisive.

An investigation on the hemicellulosic material of sweetpotato pulp, a byproduct of sweetpotato-starch manufacture, showed that the pulp contains about 15 percent of pectin. Further study is being made of the pectic material of sweetpotatoes.

OIL, FAT, AND WAX INVESTIGATIONS

A study was made of the characteristics and composition of stillingia oil, using authentic samples expressed from seeds produced in the United States and China. This was the first extensive study made of this oil by modern methods. The iodine number of the American oil was 176 and that of the Chinese oil was 169, indicating that the former had somewhat stronger drying properties. The American oil contained 2.5 percent less of saturated fat acids and 5 percent more of linoleic acid than the Chinese oil, which account for the stronger drying power of the American oil. The investigation showed that the composition of stillingia oil is similar to that of linseed oil. On account of its strong drying power, stillingia oil is used, when available, in the manufacture of paints and varnishes, as well as in making linoleum. The mesocarp of the fruit of *Stillingia* (Chinese tallow tree) yields the commercial vegetable tallow used by soap makers. The tree is of interest in connection with soil conservation in the South and also as a possible domestic source of drying oil.

The seed oil commonly known as ben oil and moringa oil was also investigated extensively for the first time. The tree (*Moringa oleifera*) from which this oil is obtained was introduced into the American Tropics and subtropics from Asia many years ago. Since it is a rapid grower, even in poor soil, and is reported to be little affected by drought, it has become of interest in connection with soil conservation in certain semitropical regions of this country. A sample of seed from Haiti consisted of 26.2 percent of shells and 73.8 of kernels. The kernels contained 5.1 percent of moisture and 37.7 of oil. The oil had an iodine number of 68 and a saponification value of 186.4 and contained 22.4 percent of saturated fat acids. The glycerides were analyzed quantitatively for individual fat acids. Ben oil, which belongs to the nondrying class, can be used either for edible purposes or for making soap.

In the investigation of new sources of oils, fats, and waxes, preliminary examinations were made of oil from the kernels of the Uruguayan palm (*Cocos pulposa*), of ouricury wax from the leaves of the Brazilian palm (*Syagrus coronata*), and of the wax which separates on the surface of perilla oil on long standing.

Improved methods were developed for the analysis of tung fruits, nuts and kernels, since the older methods were found to be inadequate for present requirements. Field laboratories were established at Bogalusa, La., and Gainesville, Fla., for a comprehensive investigation on production of tung oil and byproducts in cooperation with the Bu-

reau of Plant Industry. Work was started on the improvement of methods for expelling the oil, on the development of a satisfactory solvent-extraction method, and on the utilization of hulls and press cake. Arrangements were made with the Protein and Nutrition Research Division for feeding experiments with tung meal that has been treated to make it nontoxic. Promising results were obtained in preliminary experiments to determine the value of tung press cake and extracted meal for the production of protein plastics.

Storage may have a very detrimental effect on tung nuts. Kernels from tung nuts of the 1935 crop that had been stored in the laboratory for about 3½ years (an extreme condition) were found to contain only 2.6 to 11.7 percent of extractable oil, whereas analyses made early in 1936 showed an oil content of from 54 to 70 percent. The iodine number of the oils extracted after storage ranged from 76 to 144, whereas that of the oils extracted in 1936 was 163 to 166, which are normal values. Deterioration in less degree may occur during normal periods of storage. This subject, which will receive further study, is a matter of importance to both growers and oil millers.

PROTEIN AND NUTRITION RESEARCH

DIGESTIBILITY OF PROTEINS

The nutritive value of a protein depends on its content of certain amino acids and its digestibility. Some protein substances are scarcely acted upon by the enzymes of the digestive tract. Others may be only partly digested, leaving some of the amino acids in chemical combinations that cannot be assimilated and utilized in body building. A protein that cannot be digested to the extent that all its nutritionally essential amino acids are made available for assimilation is of no more value than if it completely lacked those amino acids that cannot be liberated. It is important, therefore, to know how readily certain nutritionally essential amino acids are liberated from different proteins by digestive agents.

Laboratory studies on the rate of liberation of cystine when casein is digested with trypsin showed that this amino acid is liberated very readily. When the digestion was conducted in an alkaline medium, a large part of the casein cystine was destroyed. Taking into consideration the amount destroyed, it is estimated that nearly 80 percent of the cystine was liberated from casein in 24 hours. When the digestion was conducted in a slightly acid medium, the cystine was again liberated very readily, but at a slower rate than when the digests were alkaline. There was no destruction of the cystine in the acid digests. The following observations were made with regard to the instability of cystine under different conditions: (1) Cystine in casein is much less stable toward dilute alkali than is uncombined cystine; (2) destruction of cystine in tryptic-casein digests at pH 8 to 9 is greatly increased when uncombined cystine is added; (3) destruction of cystine in casein at pH 8 to 9 is much greater in the presence of trypsin than when the casein is digested with alkali alone at the same pH value; (4) in tryptic-casein digestions at pH 8 to 9 practically all the cystine of the commercial trypsin used was also destroyed.

PROTEINS OF CORN

Feeding experiments demonstrated that the proteins of corn have a higher food value than is generally recognized. In fact, corn proteins were shown to be more efficient for promoting growth than the best grade of casein when fed at the same protein level in the diet. By feeding freshly ground whole corn, all the proteins of the corn kernel were included. In the past, most of the feeding experiments were not made with the whole corn kernel, but with only one or two of its isolated proteins or with products such as corn gluten, which do not represent the total protein of corn. The nutritive value of corn has often been erroneously appraised in terms of zein, a protein lacking in two nutritionally essential amino acids, without taking into account the other 50 or 60 percent of proteins of corn that have a high food value. In the light of present-day knowledge, it appears very probable that in many of the former feeding experiments with corn the supply of vitamins and mineral elements was inadequate. In the feeding experiments reported herein, the required amount of mineral salts was mixed with the ground corn, together with a small amount of cod-liver oil to supply vitamins A and D. Other vitamins were supplied by daily feeding each animal a definite quantity of solution containing known quantities of the different vitamins in pure, crystalline form. By following this method, instead of using yeast or other vitamin concentrate, the experimental animals received no other protein than that contained in the corn.

Since about 80 percent of the corn produced in the United States is fed to farm animals, and a considerable part of the remainder is converted to meal and breakfast foods for human consumption, it is important to know the amino acid composition of the whole corn kernel. Zein, the chief protein of corn, contains no lysine or tryptophane, both of which are indispensable in animal nutrition. However, feeding experiments demonstrated that this deficiency is supplied by other proteins in the whole corn kernel. Using the method developed in this Bureau and previously used for the determination of amino acids in wheat and its milled products, in soybeans, and in navy beans, quantitative determinations were made of the amino acids in corn. Not much difference was found between yellow corn and white corn with respect to their amino-acid components. Cystine, tryptophane, tyrosine, arginine, histidine, and lysine were all found to be present.

EFFECTS OF STORAGE ON PROTEINS OF GRAINS AND SEEDS

Studies were continued on the effects of storage on the proteins of soybeans, soybean meal, wheat, whole-wheat flour, and white flour, and during the past year corn and corn meal were added to the list of materials under investigation. Knowledge regarding the nature and extent of changes during storage is not only of scientific value but has an important bearing on questions relating to the utilization and nutritive value of agricultural products. The importance of such knowledge has been emphasized by the recent attention given to long-time storage of surplus grain.

Striking changes occurred in the proteins of all the meals and flours during storage. In every case there was a decrease in the solubility of the proteins. There were also decreases in true protein

content, indicating a break-down of the proteins. Most of the samples were found to be less digestible after storage than when fresh. The protein of some seeds seems to be affected more than others. At ordinary room temperature (75° F.) changes take place to a much greater extent than at 30°. The proteins of meals and flours stored in closed containers do not change as much as when stored more exposed to the air, as in bags. The total nitrogen content and the free ammonia in all samples remained constant throughout the storage periods.

In the soybean meal, the rate and extent of the changes were about of the same order in both the fat-free meal and in meal containing 11 percent of fat. The samples stored in bags changed to a greater extent and more rapidly than did those stored in closed glass jars. After storage of the fat-free meal in bags for 24 months at 76° F., the percentage decreases in true protein, solubility, and digestibility were 14.7, 24, and 26.6, respectively. Corresponding values for the whole seeds stored in jars at 76° F. for the same period were 4.6, 12.3, and 17.5, respectively.

In wheat the most striking features, as compared with soybean meal, were the much greater changes that occurred in the true protein and solubility values. The proteins of white flour changed more than did those of whole-wheat flour under the same conditions. Decreases in solubility of the proteins of white flour were much greater than in those of whole-wheat flour. In white flour stored in jars at 76° F. for 1 month and for 12 months, the percentage decreases were 42.8 and 49.3, as compared with 22.4 and 30.8, respectively, for whole-wheat flour stored under the same conditions.

Although corn-storage studies had been in progress for only a little over 6 months, marked changes were observed, particularly in the true protein and solubility values. The rapidity with which the changes occurred is especially noteworthy. The drop in true protein value of corn meal stored in jars at 76° F. for 6 months considerably exceeded that for white flour after storage for 12 months under similar conditions. The change in digestibility was about of the same order as that of the wheat samples.

SELENIUM IN TOXIC PLANTS

Previous chemical studies on seleniferous grains, particularly wheat, developed considerable evidence that selenium is present in the seed in organic combination and that it is closely associated, if not combined, with the protein. Hydrolysis of wheat gluten and fractional crystallization of the resulting mixture of amino acids showed that most of the selenium accompanied the so-called leucine fraction. Because of the difficulties involved in separating the small fractions containing selenium, it was decided to work with a plant material containing much more selenium than ever found in wheat. A variety of *Astragalus* was selected that contained 200 to 300 times as much selenium as occurs in wheat.

A procedure has now been developed whereby an apparently homogenous, crystalline seleniferous compound can be isolated from extracts of *Astragalus* without resorting to precipitation with mercury, as was formerly done. This compound crystallizes from water in the form of prisms which exhibit double refraction and decompose

at 250° to 260° C., leaving a clear reddish oil. It contains about 18 percent of selenium and 10 of nitrogen. It also contains sulfur, and gives a strong positive reaction for amino groups when tested with the ninhydrin reagent. The properties and behavior of this compound indicate that the selenium is tied up with an amino acid or a peptide of low molecular weight. Quantities of this crystalline substance are being prepared for complete analysis and identification. There is evidence that one or more other selenium compounds may be present in the *Astragalus* extracts.

VITAMINS

It has been reported that raw soybeans contain an oxidase that destroys vitamin A under certain conditions. Such an oxidase might be expected to have a destructive effect also on other vitamins and thus account for the fact that animals do not grow satisfactorily when restricted to a diet in which the protein is supplied exclusively by raw soybean meal. Feeding experiments in which a raw-soybean diet containing added vitamin supplements was compared with a raw-soybean diet and daily administration of the vitamin supplements, apart from the diet, indicated that there was no marked destruction of the vitamins as a result of their contact with the raw soybean meal, under the conditions of the experiment. It seems, therefore, that the unsatisfactory rate of growth with raw soybeans alone is attributable to a protein, rather than a vitamin, deficiency.

International standards for vitamins A, C, and D have been supplied during the year in limited quantities to vitamin investigators in the United States who are working in colleges and universities and in agricultural experiment stations.

ALLERGEN INVESTIGATIONS

Investigation of the allergens of agricultural products is a basic research project set up under the Bankhead-Jones Act. While it is primarily exploratory, that is, designed to discover fundamental scientific facts and principles, nevertheless the knowledge gained in this research is of vital concern to agriculture because the use of certain products derived from agricultural materials may be seriously limited by unfounded suspicion that they cause some of the allergic disturbances suffered by at least 10 percent of the people in the United States.

Allergic diseases in the human result from specific and exaggerated sensitiveness to certain foods, plant pollens, and fibers, or to dusts formed by disintegration of these products. In these products and by-products of agriculture are minor components called allergens, which act as incitants of disease. Where the allergens occur, to what they owe their specific toxic action, and under what conditions they are stable or unstable are problems that direct inquiry into their chemical nature.

FRACTIONATION OF ALLERGENIC PROTEINS OF COTTONSEED

Fractional separation of the proteins of the cottonseed kernel led to concentration of the principal allergenic agents in a water-soluble portion containing both protein and carbohydrate. With this fraction,

called CS–1, important differences were established among a group of allergic subjects. All members of the group exhibited some evidence of allergic sensitiveness to cottonseed in clinical examinations. Subsequent comparisons of their reactions to the CS–1 fraction and to the usual diagnostic extracts proved that clinical sensitiveness to cottonseed was invariably accompanied by skin sensitiveness to the CS–1 fraction.

Unexpected complexities have been encountered in the further chemical study of the allergenic fraction CS–1. The carbohydrate portion was removed completely in fraction CS–2 without altering the allergenic properties of the remaining protein. By reaction with picric acid a protein picrate fraction, CS–3, was formed that retained, apparently, all the physiologic properties of the original protein. An intense yellow color contributed by the picric acid permitted development of the new technique in further analytical separations of the allergenic component. A solution of the active protein picrate formed a sharply defined yellow layer when passed through a column of aluminum oxide. In effect, the aluminum oxide was found to adsorb selectively the allergenic protein picrate. Continued passage of large volumes of solvent through the column resolved the original layer of adsorbed protein picrate into supplementary layers, visible bands differing in width and color intensity.

Interpretation of evidence secured in the resolution of the original adsorbed layer rests on further chemical and clinical study of the separate fractions obtained by this procedure. Multiple layering or banding, as described, signifies discrete differences in chemical composition of the separate layers. Removal of the separate layers, recovering the adsorbed material, and subjecting the separated products to repeated passage through aluminum oxide has provided several subfractions of the original protein picrate. In each instance the adsorbed material has proved active in clinical tests. Slight qualitative differences have been observed, however, in the allergenic activity of two separate layers that contain the major portion of the original protein picrate.

Several lines of investigation have been opened by the fractionation resulting from formation of an active picrate of the allergenic protein and selective adsorption of this protein picrate on aluminum oxide. Further removal of a small portion of inactive material has been attained. Resolution of the adsorbed protein picrate provides a means for separation of subfractions for clinical tests and bioassays and for further chemical characterization of solubility measurements.

Three subfractions obtained from the separate adsorbed layers have been subjected to an extensive series of solubility measurements. Successive fractions obtained in this procedure have shown unexpected irregularities in chemical composition and allergenic activity. These variations may be due to slight differences in closely related chemical entities that are not readily separated into homogenous fractions. However, purification of the allergenic components thus far attained has made feasible a more critical examination of small but important differences in the allergic constitution of the human subject.

CHEMICAL AND CLINICAL EXAMINATION OF REFINED COTTONSEED OIL

Refined cottonseed oil and the plastic or hardened shortening fats made from the refined oil are the most important edible derivatives of the cottonseed. Edible oils and fats from this source alone comprise about one-fourth of all the primary fats consumed as food. Therefore, whether refined edible oils and fats from cottonseed contain the allergens that are present in the seed proteins is significant to the allergic consumer.

For this investigation refined cottonseed oil and hydrogenated cottonseed oil shortening were prepared to represent typical commercial products used by food manufacturers and in the home.

The first attempt to detect cottonseed allergen in the refined oil was by an extraction process designed to separate and concentrate any water-soluble ingredient in suspension or solution in the oil. Exhaustive extraction of 3 liters (3.2 quarts) of cottonseed oil yielded no evidence of protein or other nitrogenous substance. Extractives from the edible oil were also subjected to clinical tests to detect the presence of the seed allergens. Negative results were obtained with a technique capable of demonstrating 1-millionth of 1 percent of allergenic proteins of cottonseed.

Failure to detect any trace of allergen in the refined oil indicates that allergic subjects who are sensitive to cottonseed should experience no distress if the oils or shortenings are included in their diet. Both refined cottonseed oil and cottonseed-oil shortening were fed to cottonseed-sensitive individuals for intervals of 1 to 2 months. No ill effects resulted from continually consuming either the oil or shortening in quantities considerably greater than usual dietary portions.

Oils and fats derived from cottonseed and from other oil-bearing seeds are invariably refined in preparing them for edible uses. Evidently the refining procedures effectively remove the allergenic proteins found in the oil-bearing seeds and in the crude, unfiltered vegetable oils.

ANAPHYLACTIC SENSITIZATION OF GUINEA PIGS TO EXTRACTS FROM AGED COTTON LINTERS

Dusty debris from upholstery is recognized as a specific excitant of asthma. This fact led clinicians to the hypothesis that a gradual disintegration of cotton linters with age resulted in generation of an allergen. However, when linters were aged in hermetically sealed containers there was no evidence of spontaneous generation of an allergen affecting dust-sensitive subjects.

Extracts from the several samples of aged linters did induce, in many instances, positive skin reactions, indicating the presence of either an antigen or a nonspecific irritative agent. Similar reactions were observed in conducting skin tests with heterogeneous mixtures of dust obtained from upholstery containing cotton linters. These observations suggested a further examination of the aged but unused linters to determine whether linters or dust contain an antigenic or a nonspecific physiologically active principle.

In several previous attempts to characterize a specific dust antigen, no investigator had been successful in establishing in animals induced sensitiveness to dust or to the usually suspected parent substance, cotton linters. This observation was confirmed in repeated failures

to sensitize guinea pigs with water extracts of aged linters and linters dust even when the extract was administered in multiple doses totaling 5 to 6 milliliters.

A technique that had been applied previously to the sensitization of guinea pigs to ragweed pollen was found adaptable to sensitization of these animals with water extracts from both linters and dust. Alum added to the extracts caused formation of a precipitate when the solution was made neutral. Subcutaneous injection of this suspension led to the development of a uniform degree of anaphylactic sensitiveness, which could be demonstrated by a subsequent administration of an untreated water extract of the linters. The same technique was applied in sensitization of guinea pigs to house dust.

Successful sensitization of guinea pigs to cotton linters and dust extracts made possible a comparison of the antigenic properties of unused aged cotton linters and heterogeneous mixtures of house dust. One group of animals was sensitized to linters extract and another to dust extract. The animals sensitized to linters extract were injected with dust extract. The animals sensitized with dust extract were injected with linters extract. These crossed reactions resulted in anaphylactic shock in both groups, showing that the same antigenic principle was present in both cotton linters and house dust.

When crossed reactions were conducted with extracts of different mixtures of dust obtained from upholstery, wide variations were noted in antigenic activity. These results indicated the presence of more than one specific sensitizing agent. Important also to the interpretation of these experiments was the detection of a nonspecific toxic agent in a dust obtained from old linters upholstery. Normal animals in which no specific sensitiveness had been established succumbed to injections of an extract of this dust. Symptoms were like those observed in anaphylaxis, resulting in collapse and often death. If the same or a similar nonspecific toxic factor occurs in cotton linters, its concentration is significantly less than in dust obtained from upholstery. Available data show no correlation between the specific sensitizing and the nonspecific toxic principles. The physiologic and chemical properties of both are important to the interpretation of the sensitizing functions of protein and nonprotein nitrogenous components of cellulosic materials.

ANTIGENIC PROPERTIES OF ALLERGENIC COMPONENTS OF COTTONSEED

Hypersensitiveness to foreign proteins can be induced in experimental animals. This induced exaggerated sensitiveness and the collapse or fatal shock resulting from exposure of the animal to the sensitizing protein comprise experimental anaphylaxis. Important differences have been emphasized in comparing induced anaphylactic sensitivity in the animal with the spontaneously occurring hypersensitiveness of allergy in the human. However, similarities between the two reactions suggest that both phenomena may be founded on the same fundamental physiologic alterations. The allergic and anaphylactic responses are being studied with the object of determining the chemical nature of substances capable of producing these reactions.

Concentration and fractionation of the principal allergenic components of the cottonseed kernel have provided protein fractions that

have chemical and physical properties different from the usual anaphylactogens. A fraction that possesses a high degree of specificity and potency as an allergen apparently contains a protein previously unrevealed by chemical fractionation of the nitrogenous components of this seed. By chemical characterization this allergenic fraction resembles a degradation product and would not therefore be expected to induce precipitin formation or anaphylactic sensitiveness. However, when injected into rabbits this fraction induced production of precipitin, a characteristic of the high molecular weight proteins. Sensitivity to the allergenic fraction was induced in guinea pigs by injecting them with the sensitized rabbit-blood serum. Anaphylactic sensitiveness was also induced in guinea pigs by direct injection of a saline solution of the allergenic fraction. These observations demonstrated that the allergenic components of cottonseed function also as a typical antigen. In an extensive series of crossed reactions the crude water extract of whole cottonseed embryo, the allergenic fractions, separated and purified, and other previously known proteins of the cottonseed were employed for sensitizing and testing guinea pigs for anaphylaxis. Results showed that the principal allergenic component of cottonseed is an immunologically distinct entity. It passes readily through semipermeable membranes and may be obtained from the whole cottonseed embryo by dialysis, differing in this respect from the usual type of native antigenic proteins.

Heating the allergenic fraction in water solution for 1 hour 40 minutes at 120° C. did not diminish or alter appreciably the antigenic properties. Formation of a picrate of the allergenic protein in the course of fractionation and subsequent adsorption on aluminum oxide did not affect the capacity to establish anaphylaxis. With respect to these properties the anaphylactogen and the allergen were alike. Whether the component effecting anaphylactic sensitization in animals is identical with that which induces specific cutaneous reactions and other allergic symptoms in the human subject has not been proved. To accomplish this objective requires further development of the purification technique and refinement of available criteria of physiologic activity in the experimental animal and in the human subject.

INDUSTRIAL FARM PRODUCTS RESEARCH

HIDES AND SKINS

Further insight into the physiological processes whereby certain bacteria can live and proliferate in saturated solutions of salt (sodium chloride) is essential to a better understanding of curing processes employing salt. This is applicable not only to the curing of hides and skins but also to the preservation of foods such as vegetables, meats, and fish. Fundamental research was continued, therefore, to ascertain the factors controlling the development of salt-tolerant micro-organisms. Studies were made on the influence of oxygen tension, protein concentration, salt concentration, hydrogen-ion concentration, and oxidation-reduction potential upon the growth of such organisms. The results of some of these studies are being prepared for publication.

That the halophilic bacteria are much more widely distributed in nature than heretofore suspected has been shown in work recently

published by the Bureau, in which such bacteria were isolated from soil, water, dung, and freshly flayed calfskin. Of particular interest is the fact that the sulfur-oxidizing bacteria occurring in sulfur springs were found to be capable of growing in saturated salt media.

The hides and skins and tanning industries have shown marked interest in the Bureau's studies on the possibility of obtaining better curing of hides and skins, with consequent reduction of spoilage losses, by adding antiseptic chemicals to common salt. From laboratory curing experiments during the past year the following observations were made regarding the efficacy of selected chemicals for this purpose. Phenothiazine mixed with salt proved to be ineffective. A preparation comprising about 84 percent of sodium bicarbonate and 16 percent of a dichloroazodicarbonamidine was found to be quite effective in preserving calfskins when mixed with salt to the extent of 0.2 percent of its weight. Anhydrous sodium sulfite, when added at the rate of 1.5 percent of the weight of salt used, was also found to be highly effective. It was far superior in this respect to equivalent concentrations of the acid sulfite, hyposulfite, acid sulfate, and sulfate of sodium, all of which have been suggested for the purpose. The very favorable preliminary showing of the dicarbonamidine compound and of sodium sulfite warrants their further study and large-scale trial.

A semicommercial curing experiment with heavy cattle hides preserved with salt plus sodium silicofluoride and paranitrophenol is still in progress. Observations made thus far indicate that the chemicals added to the salt for curing do not subsequently interfere with the vegetable-tanning process.

Preliminary studies on retarding microbial growth, which causes spoilage of cured hides and skins, showed that, if their moisture content is sufficiently high, resalting with an excess of salt will not stop bacterial degradation. Resalting with small amounts of salt, up to 6 percent of the weight of the cured stock, tended to give better preservation than large excesses.

In experiments on the long-time cold storage of salted calfskins, selection, grading, and physical testing were completed on leather made from the third group of skins taken out of storage after 40 months. The results indicated that the skins had suffered no loss in leather-making qualities. Skins over 4½ years old that have been in cold storage for a little more than 4 years are being tanned commercially into chrome-calf leather.

Through cooperation of the Bureaus of Animal Industry and Dairy Industry, and as a part of the program of research on the influence of animal life history on the quality of hides and skins, hides were obtained from steers that died from lack of vitamin A and from lack of vitamin D for comparison with hides from normally fed animals. These hides are being tanned, one side commercially, and the other side experimentally, for subsequent examination and study.

TANNING MATERIALS

In the program of research, in collaboration with the Bureau of Plant Industry, on the development of new domestic tanning mater-

ials that preferably would serve also as new crops for agriculture, special attention was given to canaigre (*Rumex hymenosepalus*). The roots from experimental plantings made in New Mexico and Texas in the fall of 1937 were harvested during August and September 1938.

Observations on the plantings in New Mexico indicated that in regions having extremely low rainfall during the growing season irrigation may be essential to the production of acceptable yields of canaigre roots.

The Texas canaigre plantings were of particular interest because roots from the same 50 parent hills were planted at 12 places to determine the relative adaptability of the different locations for growing canaigre. Plant growth and yields of roots varied widely. Only 2 locations, Winter Haven and Lubbock, showed particularly good yields of roots. An effort will be made to determine the factors responsible for the superior production at these places. The wide range in yields at these 12 locations emphasized the need for more comprehensive information on areas best adapted to the large-scale production of canaigre roots before commercial growing is undertaken. In order to obtain such information plantings were made by the Bureau of Plant Industry at new locations, including 4 places east of the Mississippi River.

Over 200 samples of canaigre roots collected from the experimental plantings were analyzed for tannin content, and analyses of 50 samples representing new progeny plantings are under way. Roots from 123 hills at the 3 locations in Texas showing the best yields were analyzed separately to acquire data on the range in tannin content that may be expected. The range was so wide that progeny studies for the selection and development of individuals or strains of high tannin content will be necessary for adequate crop production. The tannin content of the moisture-free roots from the 12 Texas plantings ranged in average per location from 14.8 to 27.6 percent.

Laboratory studies on the utilization of the nontannin constituents of canaigre roots for industrial products are in progress. In preliminary experiments with six samples, the residues left after removal of tannin yielded upon acid hydrolysis from 25.5 to 36.6 percent of reducing sugars. These results indicate a favorably high content of carbohydrate material for producing alcohol or organic acids by fermentation.

Work was started in collaboration with the Bureau of Plant Industry on the further development of domestic sumacs as tanning materials. Samples of leaves and stems from 3 species grown at the Arlington Experiment Farm of the Department in Virginia from seeds and root cuttings were analyzed, and the data are being held for comparison with results from similar collections in subsequent seasons. Two sumacs native to Texas (*Rhus copallina* and *R. trilobata*) are of special interest because of the high tannin content of their leaves, which, based on the limited results so far obtained, ranges from 30 to 38 percent. Additional specimens from Texas will be collected and analyzed to augment the data now on hand from the analysis of 6 species. Sumacs native to Iowa are being studied in collaboration with the Soil Conservation Service for the selection and propagation

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of plants that might best serve in the dual capacity of supplying tannin and preventing soil erosion. Thus far, 29 samples representing 4 species have been analyzed.

A study of the tannin content of the perennial legume *Lespedeza sericea* was continued in cooperation with the Bureau of Plant Industry. This plant, which was introduced into this country as a hay and grazing crop, especially for the Southeastern States, is valuable as a soil-improvement and soil-holding crop, but is not entirely satisfactory for hay or forage because of its comparatively high tannin content. Efforts are being made to overcome this difficulty by selective breeding and by harvesting the plant when its tannin content is at a minimum.

A special collection of leaves of *Lespedeza sericea*, grown at the Arlington Experiment Farm, was examined to determine the relationship between tannin content and maturity of the plant as indicated by height. The samples represented cuttings made throughout the summer on five plots, each plot being cut when the plants reached a definite height. Seven cuttings were made of plants 6 inches high, four of plants 12 inches high, four of plants 15 inches high, three of plants 18 inches high, and two of plants 24 inches high. The tannin content of the leaves ranged from 4.4 percent for the first cutting at 6 inches to 14 percent for the second cutting at 24 inches. Frequent cutting did not keep down the tannin content. In every plot tannin in the leaves reached a maximum in July. From the examination of one set of samples it appears that ensiling *L. sericea* may be an effective way to reduce the tannin content and make the plant more palatable to cattle. Detailed data from a previously reported study on seasonal variation in the tannin content of *L. sericea* were published.

For comparison with *Lespedeza sericea*, authentic specimens of *L. juncea* from Virginia, North Carolina, Georgia, and Alabama were analyzed for tannin content. The leaves contained, on the moisture-free basis, from 8 to 11.2 percent of tannin, a range slightly lower than for *L. sericea*.

A new glass extractor with automatic and accurate control of temperature was developed and used satisfactorily for the extraction of canaigre for tannin analysis.

LEATHER

Why some chrome-retanned leathers show poor resistance to acid rotting, whereas others show superior resistance, is still an unanswered question. In an effort to throw light on it, an elaborate set of experimentally tanned leathers was prepared. These leathers have been submitted to accelerated aging and are now being tested and analyzed. This set comprises leathers of several vegetable tannages alone and the same leathers retanned with the following types of chrome liquors: (1) Sulfur dioxide-reduced; (2) basic chrome alum; (3) glucose-reduced. The purpose is to determine the influence of the kind of chrome-retanning liquor on the permanence of leather.

Two commercially tanned goatskin leathers, made by the two-bath chrome process, were acquired for experimental binding tests in the Government Printing Office. One of these leathers gave promising results on accelerated aging, showing a loss in strength, after 12 and

18 weeks' exposure in the gas chamber, of only 21 and 34 percent, respectively. The Government Printing Office reported that this leather was entirely satisfactory for binding purposes but showed a tendency to rapidly tarnish imitation gold lettering. The other leather showed moderate resistance to acid rot. On accelerated aging, it lost 38 percent of its strength in 12 weeks and 58 percent in 18 weeks.

A new type of gas chamber, not dependent on illuminating gas, was developed for testing and research work on the accelerated aging of leathers. The exposure chamber is made entirely of glass and is maintained at a constant temperature. Acidic pollution of the atmosphere within the chamber is provided and controlled by means of a constant-level lamp burning, as a fuel, methyl alcohol containing a known concentration of normal amyl sulfite. In this manner a very low but constant output of sulfur dioxide is obtained. The operation of the apparatus can be regulated to provide certain definitely specified conditions. It therefore offers a means that could be adopted generally for the comparable testing of leather and the study of the effects of various materials and processes.

In collaboration with the British section committee on the determination of the acidity of vegetable-tanned leather, of the International Society of Leather Trades' Chemists, a set of 13 specially selected and prepared leathers was subjected to accelerated aging in the gas chamber, tested, and analyzed. Others collaborating in this work submitted these same leathers to the hydrogen peroxide and the oxygen-bomb tests. The purpose was to compare 3 recently proposed methods for the accelerated aging of leather. The results and conclusions from these studies are not yet available.

Through committee memberships the Bureau cooperated with the American Leather Chemists' Association, the Federal Specifications Executive Committee, and the committee on shoes of the American Standards Association.

FARM WASTES

Experiments on the production of moldable plastics from sugarcane bagasse were continued, and results showing the effects of varying conditions of hydrolysis upon the strength and flow properties of the molding powders were published. Particular attention was given to the method of producing molding powders by aniline hydrolysis. Powders made by this method were far superior to those obtained by acid hydrolysis both as to moldability and strength of product. Several manufacturers have shown an interest in the commercial possibilities of molding powders made from bagasse. From cooperative experiments carried out by an automobile-manufacturing firm it appears that these products are at or near the point where they can be utilized in the production of various automobile parts. Bagasse molding powders are now being tried out as material for floor and ceiling moldings for use in the building industry. Advice and assistance were given to a sugar-producing firm in the design, erection, and operation of a pilot plant for experiments in the commercial production of molding powders from bagasse. Actual plant operation and production are expected to be under way soon. Additional laboratory equipment for molding and testing plastics was procured.

Experimental work was begun with a modification of the kraft pulping process in efforts to produce strong paper pulps from cereal straws and sugarcane bagasse. Several cooks were made of wheat and oat straws and bagasse. For the study and evaluation of the resulting pulps a beating schedule was developed, using a standard laboratory beater and sheet-forming equipment. Data on bursting and textile strengths, folding endurance, and tear resistance of the plups in sheet form are being acquired. From results obtained thus far, it appears that more chemicals, or a longer digestion period, will be required for bagasse than for straw, but that fairly strong pulps can be produced from both bagasse and straw.

The results of preliminary investigations on the use of alcoholic nitric acid as a pulping agent were published. Relatively high yields of easily bleached pulp were obtained by this method, and analysis of the pulps showed that only small amounts of α cellulose and hemicelluloses were destroyed by the reagent.

Work was completed on the application of the new conductometric method of analysis to the examination of kraft pulping liquors, and a study of the modification of this method for the examination of sulfite pulping liquors is in progress. These improved analytical methods will be valuable in conducting pulping research as well as in pulp-mill control work.

Preliminary experiments on the use of monoethanolamine as an analytical reagent for the determination of cellulose in crop residues indicated that a single treatment with this reagent removes so much lignin that only a single after-bleach treatment is required. The residue is comparable in composition with the usual analytical Cross and Bevan fraction. This new procedure results in a saving in time over that required by the Cross and Bevan method.

The results of an extensive study on the chemical and physical characteristics of representative commercial paper pulps prepared from wood, bagasse, and cotton were prepared for publication. The study was undertaken in the hope that some correlation between the cuprammonium viscosity of a pulp and its other characteristics might be discovered, but the results indicated that among the 10 characteristics determined no one can be evaluated in terms of any other.

Following the publication of the results of preliminary experiments on the removal of iron from water with lignin complexes, numerous requests were received for samples of the preparations for trial in the treatment of domestic and industrial water supplies. Preliminary tests with lignin complexes prepared from corncobs indicated that they may be suitable for the removal of fluorine from water.

The results of the studies on the utilization of various agricultural wastes by destructive distillation, which extended over several years, were prepared for publication. They indicate that the continuous type of retort is suitable for the destructive distillation of some agricultural waste materials on a commercial scale.

LIGNIN

The results of an investigation on the biogenesis of lignin indicated that lignin is not synthesized in the plant from cellulose, pentosans, or pectin, but most probably directly from sucrose.

Among the first steps in the synthesis of lignin is the production of a substance or substances having firmly bound methoxyl groups in etherlike combination. Such substance or substances may be formed in the course of splitting up of carbohydrates by a process of hydrolysis, oxidation, reduction, and dehydration, and not necessarily directly from formaldehyde by a process of methylation. Data on the percentage of methoxyl at various stages of development of the plant tended to support this hypothesis. Evidence was obtained that coniferyl alcohol or aldehyde is not, as has been claimed, an intermediate substance in the synthesis of lignin by the plant.

Experiments were conducted on the nitration of lignin under various conditions. In one series of experiments lignin was first acetylated, and the nitration of the acetylated lignin was then carried out in a mixture of glacial acetic acid and acetic anhydride. The acetyl group in the nitrated lignin was removed by hydrolysis. The nitrolignin thus obtained is being studied.

When lignin is fused with alkali, protocatechuic acid, catechol, and oxalic acid are the chief degradation products. It seemed desirable to try to degrade lignin with alkali under somewhat milder conditions. For this purpose, methylated lignin in alcoholic solution was heated under pressure with sodium ethylate or sodium methylate at temperatures ranging from 160° to 180° C. A phenolic oil was obtained in a number of the experiments. An investigation of this oil is in progress.

The results of the study on the chemistry of the lignin from wheat straw given briefly in last year's report, were published. Some progress has been made in the study of the composition and nature of lignin from nut shells. *Fomes pini*, a parasitic fungus of trees that preferentially attacks the lignin, was shown to contain a substance similar to lignin in its chemical properties, in the proportion of more than 50 percent of its dry weight.

The effect of proteins on the determination of lignin by the hydrochloric acid method of analysis was ascertained by treating several plant proteins alone and in the presence of different proportions of lignified plant material with cold 42- to 43-percent and boiling 5-percent hydrochloric acid. The results indicated that the resistance to hydrolysis of the proteins used is quite different. Therefore, in determining the lignin content of materials rich in protein, it is not possible to apply a simple correction for the nitrogenous complexes in the lignin by determining nitrogen content, multiplying by the factor 6.25 to obtain protein equivalent, and deducting this value from that for crude lignin. When the nitrogen content of the crude lignin is small, the error introduced by using the factor 6.25 is not great.

HEMICELLULOSES AND LIGNOCELLULOSES

Investigations on the chemistry and structure of the hemicelluloses and lignocelluloses in cereal straws, hays, and other forage crops were continued as a basic research project under the Bankhead-Jones Act. Laboratory work on the hemicelluloses of alfalfa hay and wheat straw was completed, and two papers giving the results of the investigations were prepared for publication. The hemicelluloses from these materials were very similar. When fractionated according to

the method of Norris and Preece, they were found to consist chiefly of the B fraction, which on hydrolysis yielded *d*-xylose, *l*-arabinose, and a uronic acid that was probably glucuronic acid or one of its methyl derivatives. The hemicellulose of alfalfa hay consisted almost entirely of the B fraction, while that of wheat straw contained also a small proportion of the C fraction.

A white, lignin-free hemicellulose was isolated from sugarcane bagasse, and a study of the constitution of this hemicellulose is now in progress. Analyses of sugarcane juice and molasses showed the presence of methoxyl and uronic acids in both, with much larger percentages in the molasses. Pectin is probably the uronic acid-containing constituent, and the methoxyl group is probably of lignin origin.

Attempts to devise a satisfactory method for isolating the hemicelluloses from lespedeza hay for study have thus far been unsuccessful. The large quantity of coloring matter in this hay interferes with the isolation of the hemicelluloses, and those obtained were rather brown in color. More success was attained in the isolation of hemicelluloses from timothy hay. After much experimentation a method was finally developed that gives a lignin-free, nearly white hemicellulose preparation. In this method the hay is first extracted with an alcohol-benzene solution to free it from fatty, waxy, and resinous material. It is then extracted with hot water to free it from sugars, soluble pectin, and starch. The material is then extracted with a hot 0.5-percent ammonium oxalate solution to remove the protopectin, after which it is partly delignified by digestion with an alcoholic sodium hydroxide solution at room temperature. The residual material is then digested at room temperature with aqueous 5-percent sodium hydroxide solution and filtered. The hemicelluloses in the filtrate are precipitated by addition of alcohol. The crude hemicellulose preparation thus obtained is washed with alcohol and with acidified alcohol to free it from sodium hydroxide and is then made lignin-free by chlorination and extraction of lignin chloride with an alcoholic solution of ethanolamine.

Timothy plants were harvested at successive stages of growth, from the time of emerging until maturity. The composition and properties of the hemicelluloses and lignocelluloses at different stages of development of the plant are now under investigation.

FERMENTATION INVESTIGATIONS

The action of submerged mold growths on dextrose was studied with respect to the lactic acid, citric acid, and gluconic acid fermentations.

The production of dextrolactic acid from corn sugar by *Rhizopus oryzae*, which previously had been carried out successfully in small rotary fermenters in the laboratory, was tried out in the large rotary fermenter in the Agricultural Byproducts Laboratory at Ames, Iowa, and demonstrated to be feasible. It was found, however, that in this process there is more danger from contamination than in the previously studied gluconic acid and sorbose fermentations. Experience gained in this operation resulted in improvements of apparatus and procedure. A new process was developed for the preparation of pure dextrolactic acid from the fermentation liquors. It involves

the conversion of the lactic acid to the zinc salt, acidification, and extraction.

Preliminary experiments having shown that *Rhizopus oryzae* is effective for saccharifying corn mash and other starchy materials, work was begun on the utilization of corn directly for the production of lactic acid. This would provide fermentable material at a cost lower than that of refined commercial glucose. Yields of dextrolactic acid from corn mash, using *R. oryzae* both for saccharification and fermentation, compared favorably with those from refined glucose. Methods of preparing the mash are being investigated. It is believed that other processes, such as the citric acid, gluconic acid, kojic acid, and ketogluconic acid fermentations, might be successfully conducted with such material.

Progress was made in the fundamental investigation of the organisms inducing the citric acid fermentation. Experiments with 16 selected strains of *Aspergillus niger* recently received from outside sources and with those already in the laboratory collection revealed marked variation in acid-producing ability, in response to nutrient variations and in resistance to zinc, aluminum, and boron. Resistance to aluminum is especially important, because traces of this element may be present in the nutrient liquors when the process is conducted in aluminum fermenters. The studies showed that addition of calcium salts was effective in reducing the toxicity of aluminum to these organisms, and that addition of magnesium salts was even more effective. The required quantity of these detoxifying elements was approximately proportional to the quantity of aluminum present. Some experiments were conducted on the production of citric acid by submerged mold growths but were not very successful. Further studies along this line will be undertaken because new data indicate the possibility of developing promising procedures.

A repeat-batch, or semicontinuous, process was developed for the production of gluconic acid by submerged growths of *Aspergillus niger*. This process depends on the tendency of the submerged fungus to rise to the surface after the rotating fermenter has been stopped and the air pressure released. Since more than 90 percent of the active mycelium may be obtained in the upper one-fifth of the fermented liquor, the relatively clear lower layer is removed, fresh solution is added, and the fermentation is continued.

As many as 13 such repeated fermentations in the small drums and 5 in the large drums have been made with no decrease in activity. The optimum glucose concentration to yield the greatest amount of gluconic acid was 12 grams per 100 cubic centimeters of fermentation solution. With this concentration, the amount of acid that can be produced per hour in the small fermenter (based on calculations for 11 fermentations) is 4.33 kilograms for the semicontinuous process, as compared with 2.97 kilograms for the single-batch process. Such marked increase in production results from the elimination of the lag phase at the beginning of a fermentation, and the maintenance of a relatively high rate of oxidation of glucose to gluconic acid, with an estimated saving of 4 to 6 hours per fermentation.

With a boron-resistant strain of *Aspergillus niger* it was found possible to ferment more concentrated solutions of glucose to gluconic acid in the presence of boric acid. The addition of boric acid to the

sugar solution permits taking advantage of the rapid fermentation rate prevailing in neutral solution, by using sufficient calcium carbonate to neutralize completely the gluconic acid produced, without precipitation of the resulting calcium gluconate. It had been observed previously that, in the absence of boric acid, precipitation of calcium gluconate occurred when the sugar concentration was above 12 percent and that such precipitation caused almost complete cessation of enzymic activity. With suitable quantities of boric acid present, glucose solutions ranging in concentration from 20 to 40 percent can be rapidly fermented to gluconic acid, whereas in the previous process glucose concentration could not exceed 12 to 15 percent without retarding the fermentation rate.

Thirty-seven strains of *Acetobacter* were studied in the laboratory to determine their relative ability to produce organic acids from glucose in the absence of calcium carbonate, that is, in media of increasing acidity. As was expected from experience with other types of oxidative fermentation, aeration was found to increase the rate of fermentation. Most of the strains produced very little acid, but some readily attacked the glucose molecule, producing acids other than, or in addition to, gluconic acid. The best strains will be used in a more detailed study of gluconic acid production under acid conditions in the hope that a continuous process for the production of free gluconic acid can be developed.

Laboratory studies on the production of 5-keto-gluconic acid from glucose by *Acetobacter suboxydans* in rotary fermenters resulted in definite improvement. The time required for completely fermenting a 10-percent glucose solution was reduced from 7 days to about 3 days. The process comprises two phases. In the first, the glucose is oxidized to gluconic acid; in the second, the gluconic acid is oxidized to ketogluconic acid. Efforts are being made to hasten the over-all process by reducing the time required for the second phase, which proceeds more slowly than the first.

Two vat-type aluminum fermenters, designed for operation under pressure, were constructed and found to be satisfactory for the production of gluconic acid. Further studies are in progress to demonstrate their utility for the production of lactic acid, sorbose, the ketogluconic acids, and dihydroxyacetone by fermentation. If they can produce results equal to those obtained with the rotary fermenters, it is believed such vats will be preferred for large-scale industrial operations .

In studies to determine the possibility of producing paper pulps from crop residues by anaerobic fermentation with thermophilic bacteria, it was found that there was less decomposition of cellulose and pentosans in chopped wheat straw than in straw flour. However, the loss was great enough to indicate that this type of fermentation is not very promising for producing pulps.

MOTOR FUELS

The entire problem of motor fuels from agricultural materials was comprehensively summarized in Miscellaneous Publication No. 327, Motor Fuels from Farm Products, issued during the year. This publication discusses the scientific, engineering, and economic factors involved, and indicates the kind of additional data required and the

research necessary to acquire such data. It corrects some widely prevalent misconceptions relating to production and use of alcohol for motor fuel and has served to rationalize the discussions on the economy of agricultural motor fuels, which heretofore have been somewhat controversial. The publication has become an authoritative handbook on the subject.

It is believed that research is needed on many phases of the problem before alcohol production for use as motor fuel is undertaken. Under present conditions there would be grave risk of financial loss to investors in such manufacturing plants. Plans have been formulated for a research pilot plant at Peoria, Ill., in which essential problems relating to reduction in cost of producing alcohol, advantageous utilization of process byproducts, distribution, and use of products will be studied.

Pending the necessary experimentation in this plant or elsewhere, and the development of processes whereby low-cost alcohol and valuable byproducts can be produced from kinds and quantities of farm products that will have a significant bearing on the crop-surplus problem, the manufacture of power alcohol by private industry will be on an economic border-line, without chance of profit except under especially advantageous circumstances.

It is believed that the manufacture of power alcohol should be undertaken only under a definite plan specifically designed to meet existing economic handicaps. The reason for undertaking the production of motor fuels from agricultural materials, that is, whether the objective is assistance to agriculture or merely conservation of national fuel resources, should be clearly understood in advance, because with either objective there will be certain limitations, which must be considered.

CHEMICAL CONVERSION OF OILS, FATS, AND WAXES

The arylstearic acids and their esters previously prepared from oleic acid were found to be useful as intermediates for further synthesis. Many of them can be readily sulfonated with concentrated sulfuric acid and yield sulfoarylstearic acids. The sodium salts of such sulfonic acids have emulsifying properties and penetrant action, as measured by the Draves-Clarkson test. The following tentative conclusions have been drawn from experiments with these compounds: (1) Their penetrant properties in neutral solutions compare favorably with those of some commercial wetting agents; (2) their wetting efficiency decreases in very acid and very alkaline solutions; (3) in neutral solutions the decrease in wetting efficiency with increasing dilution is less for the sulfoarylstearic compounds than for most commercial wetting agents; (4) the resistance to precipitation by calcium salts is about the same for the sulfoarylstearic compounds as the average for commercial wetting agents; (5) the disulfonated products are less effective penetrants than are the monosulfonated products, but their calcium salts are more soluble. Experiments will be made on the fat-splitting properties of these sulfonated compounds.

In studies on the hydroxylation of oleic acid, an improved method was devised that is also applicable to the hydroxylation of other unsaturated fat acids, glycerides, and other esters and alcohols. It

was found that potentially valuable aldehydic products can be prepared from glycerides of fats and vegetable oils without isolating the unsaturated fat acids and also without isolating the intermediate hydroxy compounds. Using the improved hydroxylation method and an improved procedure for breaking down the products and recovering derivatives, pelargonic aldehyde (n-nonaldehyde) and azelaic acid were obtained from oleic acid and from its glycerides and other esters. Oleyl alcohol yielded pelargonic aldehyde and 9-hydroxypelargonic aldehyde. Castor oil yielded, besides azelaic acid, a volatile compound that was identified as α-nonenaldehyde. This compound should prove valuable as an intermediate for use in synthesis since it contains an ethylenic linkage in addition to the reactive aldehyde group. The 9-hydroxypelargonic aldehyde obtained from oleyl alcohol should also be valuable as an intermediate. These aldehydes may find application in the preparation of commercial products such as perfumes, flavors, plastics, synthetic fibers, and rubberlike materials.

PLASTICS

Work was continued on the utilization of dextrolactic acid in a new type of three-component alkyd resin involving the use of polyhydric alcohols, aliphatic hydroxycarboxylic acids, and polybasic acids. The resins which have been most intensively studied result from the reaction of glycerol dilactate with straight-chain aliphatic dicarboxylic acids. Some of the dibasic acids thus used are succinic, azelaic, and sebacic acids. In most instances the three components used in the preparation of such plastics are derived from agricultural materials.

A study of the several steps in the reaction is now under way. The production of glycerol dilactate, which finds direct use in the textile industry, has been given particular attention. The plastics obtained by the reaction of glycerol dilactate with aliphatic dicarboxylic acids of the series succinic to sebacic have rubberlike properties. Those containing azelaic and sebacic acids are practically insoluble in the aliphatic hydrocarbons. They are miscible with rubber and may find use for improving the resistance of rubber to solvents. The reaction product of glycerol dilactate and phthalic anhydride may find use in the preparation of coating compounds. It is compatible with cellulose nitrate in some commonly used solvents and produces tough elastic films.

Work on the preparation of methyl acrylate from dextrolactic acid showed that the three essential reaction steps, esterification, acetylation, and pyrolysis, proceed with fair yields. The results corroborated those of earlier British investigators, which indicated that an over-all yield of about 60 percent of crude methyl acrylate may be obtained. On polymerization, the redistilled methyl acrylate gave a transparent, tough, rubbery plastic. It is not likely, however, that this process can compete favorably with other methods now in use for the manufacture of methyl acrylate.

SOYBEANS AND SOYBEAN PRODUCTS

The Regional Soybean Industrial Products Laboratory at Urbana, Ill., continued to investigate soybeans and soybean products for the

purpose of gaining further fundamental knowledge bearing on industrial utilization and the suitability of different varieties for specific purposes. This is a basic research project under the Bankhead-Jones Act, and is carried on in cooperation with the Bureau of Plant Industry and the agricultural experiment stations of the 12 North Central States.

As an aid to the agronomic investigations of the Bureau of Plant Industry, in cooperation with the State agricultural experiment stations, chemical analyses were made of about 925 additional samples of soybeans of different varieties and strains and representing also variations in climate, soil type, fertilizer treatment, and other cultural conditions. All samples grown in 1936 and 1937 that possess immediate interest have now been analyzed, as well as 445 samples of the 1938 crop. Several hundred other analyses and special determinations were made in connection with the agronomic, chemical, and technological investigations.

Research was continued on the improvement of existing methods for the analysis of soybeans and soybean products and on the development of new methods. A method of extraction with 0.8 normal trichloracetic acid solution was developed as a measure of nonprotein nitrogen, the amount of nitrogen extracted being comparable with that removed by electrodialysis. This method, which provides an easy, rapid procedure for determining "dialyzable" nitrogen, was tested on a number of soybean-meal samples of widely varying nitrogen content with satisfactory results. A method for determining saturated fat acids in soybean oil, now being studied, seems to be satisfactory. It requires only about one-tenth of the time required for previous methods. By this method, which is based on the work of J. B. Brown of Ohio State University, the solid fat acids are separated from the liquid acids by crystallization from acetone solution at low temperatures. This procedure when checked with the Bertram permanganate oxidation method and the Twitchell method, as modified by the fat analysis committee of the American Chemical Society, gave results for soybean oil in close agreement with those found by the Bertram method, which is believed to be the more accurate of the two.

A critical study by statistical methods of the many data on iodine number and refractive index of soybean oils indicated a straight-line relationship between the two, within experimental error, but this line was different for soybeans of different years and for those of any one year, depending on the method of extraction. From a study of the influence of time of heating, storage, and other factors on this relationship, it appeared that differences in the equations worked out could not be attributed to such factors.

From a study of six samples of soybean oil having abnormally low to unusually high iodine numbers (102.9 to 151.4), with regard to composition of their fat acids, the following tentative conclusions were drawn: (1) The ratio of saturated to unsaturated acids in soybean oil is fairly constant, irrespective of the total acids present or iodine number of the oil; (2) the distribution of the unsaturated acids varies in a specific manner with the iodine number, but is independent of the total acids formed and stored by the seed in the form of various lipids; (3) the regularity of variation of the

oleic, linoleic, and linolenic acids with respect to the iodine number indicates that the various unsaturated acids are formed (*a*) by a progressively stepwise dehydrogenation of a completely saturated precursor, or (*b*) by a progressively stepwise hydrogenation of a polyethenoid, and at least a triethenoid, precursor.

Various lines of investigation were pursued in an effort to obtain information on the mechanism of reversion and rancidity phenomena of edible soybean oils; and material progress was made, especially with respect to suitable means of measuring and predicting the probable keeping quality of oils. From the investigation of the applicability of the Kaufmann diene method to the determination of the extent of conjugation in normal and oxidized soybean oils, which was completed, it was determined that the presence in fats and oils of hydroxyl groups, peroxides, and possibly other oxidation products influences the magnitude of the diene value, apparently as a result of the reactivity of these substances with maleic anhydride under the conditions of the Kaufmann and Ellis methods. Pure hydroxylated compounds having appreciable initial diene values were found to have little or no diene value after acetylation. Within the limits of experimental error, the diene value of soybean oils could be related to the hydroxyl and peroxide numbers by the following equation: Diene number = 0.226 hydroxyl number + 0.0127 peroxide number.

As a part of the investigation on the durability of surface coatings containing soybean oil, a total of 154 panels, representing 119 varnishes, 115 paints, 46 enamels, and 3 aluminum paints, have been prepared and exposed on the 45° and 90° test fences at Urbana. On the basis of exposure records up to the present, it may be concluded that soybean oil is as durable as tung, perilla, or linseed oil, when it is cooked with rosin ester or Bakelite 254 resin to form varnishes in which the only variable is the type of oil. The slower rate of drying and hardening of soybean-oil varnishes apparently does not interfere with their durability. Blending 100-percent tung-oil varnishes made with Bakelite and rosin ester with similar 100-percent soybean-oil varnishes in the proportions of 1:6, 1:3, 1:2, 2:1, and 5:1 did not increase durability or hardening over that of straight soybean-oil varnishes. Interesting new soybean-oil varnishes were made by adding blends of 15 and 25 percent of Bakelite resin BR 3360 with 85 and 75 percent of rosin ester. Such blends not only reduce the cost of the varnishes, but should also increase the durability of the rosin ester and decrease its tendency to soften on aging, which has been a disadvantage in rosin ester varnishes, especially when made with soybean and linseed oils.

Further experiments definitely established the fact that the oxygen absorption of soybean and certain other oils is increased, and the rate of drying accelerated, by heating the oil with an acylating agent, such as acetic, propionic, or butyric anhydride. Measurement of oxygen absorption by several well-recognized methods indicated that acylation of soybean oil increases the rate of oxygen absorption from 7 to 20 times over that of untreated crude soybean oil. Since the method of treatment is both practical and commercially important, application has been made for a public-service patent to cover the process.

An extensive series of experiments was made to determine the relative effectiveness of various activated bleaching earths and carbons

and combinations of earths and carbon for bleaching alkali-refined, expeller soybean oil. As compared with various commercial bleaching agents, official fuller's earth resulted in poor bleaching. The use of activated carbon alone resulted in inadequate bleaching, but it was of value in supplementing the action of activated earths and filter aid. Various commercial activated carbons showed little difference in bleaching action. Siliceous filter aids, when used alone, had no bleaching action, but when used in combination with activated earths and carbons to the extent of about 0.1 percent they materially assisted subsequent filtrations. The concentrations of activated earths were varied over a considerable range (2 to 12 percent), and although some additional bleaching resulted above 6 percent of earth and 2 percent of carbon, it did not seem to warrant the increased cost of the materials used. In laboratory bleaching, optimum results were obtained by the use of a mixture of 4 to 6 percent of activated earth, 0.5 to 1 percent of activated carbon, and 0.1 to 0.5 percent of filter aid.

In studies relating to the industrial utilization of soybean meal and its constituents, further attention was given to the extraction of protein and to the preparation of plastics from the protein- and oil-free meal. The principal problem encountered in work with soybean protein dispersed in formaldehyde solution was the preparation of dispersions of practical protein concentration that would not gel in a short time. The degree to which the protein had been hydrolyzed was found to be very important. Hydrogen-ion concentration was also found to influence the tendency to gel; a dispersion of pH 8.5 or higher gelled in a few hours, if not immediately. A formaldehyde dispersion of soybean protein was used to impregnate unsized kraft paper, which was then dried to about 10-percent moisture content. When 15 to 20 sheets of impregnated paper were pressed between the heated platens of a hydraulic press, an interesting laminated sheet was obtained. By placing sheets of paper impregnated with phenolic or urea resin on the top and bottom of the stack of other impregnated sheets, a laminated sheet could be obtained that was practically as water- and warp-resistant as one made entirely with phenolic or urea resin.

Experiments were continued on the preparation of thermosetting plastics from formaldehyde-hardened soybean protein mixed with synthetic resins. Work was concentrated on soybean meal rather than on the commercial soybean "alpha protein" because the meal is cheaper and more generally available. In the preparation of molding compounds the most satisfactory results were obtained by incorporating a soft two-stage phenolic resin with the formaldehyde-treated soybean meal by passing the mixture through heated calender rolls. A mixture of 60 percent of soybean meal and 40 percent of phenolic resin worked well on the rolls and gave a molding compound that could be handled similarly to phenolic resin-wood flour molding compounds, although the time of cure was possibly a little longer. Articles molded from such mixtures appear to be resinous on the finished and fractured surfaces. They are somewhat stronger than those made from straight resin, but not so strong as those made from the resin-wood flour mixture. Their water absorption is high in comparison with straight phenolic plastics, but very low in comparison with straight protein plastics. Some of the mixtures prepared were molded

without difficulty in regular production dies in the plants of two manufacturers, and the products compared favorably with those from commercial phenolic molding compounds. The results of these and other experiments have removed all doubts as to the possibility of making a soybean-phenolic plastic. The only question remaining is how the plastic should be modified to fit some particular industrial application.

Engineering and physical investigations have been concerned primarily with expeller processing and solvent extraction of soybeans. Standard operating conditions for the half-size expeller press have been established. The results of tests to determine the effects of particle size on expeller performance have shown that power usage per unit of throughput increases rapidly as finer particles are fed and simultaneously the oil content of the residual cake approaches a minimum. The importance of particle-size-frequency distributions resulting from diverse conditions of cracking has been demonstrated in all experiments relating to expeller and dryer operation. A study was completed on the effects of variety, feed rate, moisture content, and roll clearance upon size, distribution, uniformity, and bulk density of the products of single-stage cracking of soybeans.

Viscosities and specific gravities at various temperatures, and refractive indices, have been determined for mixtures of soybean oil with hexane, trichlorethylene, and ethylene dichloride. These data are essential for diffusion calculations, pump and piping design, and rapid determinations of miscella concentrations.

Observations were made on the resistance of various metals and alloys to corrosion under conditions analagous to those encountered during solvent extraction of soybeans or in the movement and storage of quantities of soybean oil. Nickel, Allegheny metal, Hastelloy A, and aluminum were found to be satisfactory, but copper and copper-bearing alloys showed poor resistance.

The mutual solubility of soybean oil and liquid sulfur dioxide has been determined, and the investigation is being continued to obtain physical constants and properties of the oils resulting from the two liquid phases at various temperatures.

Cooperative studies were made by Purdue University Agricultural Experiment Station on the sterols, phosphatides, and carbohydrates of soybeans. A large-scale preparation of stigmasterol from soybean oil showed that about 20 percent of the sterols can be isolated as stigmasterol. Sterols from the sterol glucosides appeared to be the same as those obtained by saponification of the oil. An extensive separation into fractions was made of the phosphatidic material separated by adsorption. Evidence was obtained that nitrogen-free compounds containing phosphorus may be separated from this material. Although no crystalline stachyose was isolated from the carbohydrates of soybeans, sirups were obtained that showed qualitative indications of stachyose, and the conditions under which crystallization may occur were studied.

In cooperative work by the Minnesota Agricultural Experiment Station, some preliminary results were obtained on the respiration of soybeans of varying degrees of moisture content. The data available at present indicate that increasing moisture content markedly accelerates respiration. The results showed that the respiration of soy-

beans at different levels of moisture content follows an exponential curve. The curve differs from that obtained in previous studies with the cereal grains in that there is a rather rapid increase in the rate of respiration with increasing moisture, rather than a sharp break at some particular moisture value. The adiabatic respirometer was improved by making it completely automatic. Considerable experimentation was carried out in developing suitable equipment for conducting bulk storage trials under adiabatic conditions.

CHEMICAL WEED KILLERS

A semiplant-scale investigation was completed on the performance of a recently designed electrochemical cell for the production of sodium chlorate. This cell has a structural advantage over the type formerly used in that it permits adequate cooling at high-current concentrations and also adjustment of the gap between anode and cathode. Cells of this type were operated at five times the current concentration used in the cells that served as a basis for the Bureau's first report on the cost of producing sodium chlorate. Thus, with the same investment in the new type of cells, a threefold output of chlorate can be obtained therefrom. The new cells are of comparatively simple and inexpensive construction and permit current efficiencies of from 80 to 85 percent.

A small glass laboratory cell of the rod-cathode type was operated at various current concentrations up to 5.4 amperes per liter. At this current concentration the power consumption was very low, only 2.9 kilowatt-hours of alternating current per pound of sodium chlorate as crystals. Work on similar cells of larger capacity is under way.

The Bureau collaborated with the Bureau of Plant Industry in a study to determine whether there is any relation between the acidity of sap in crop plants and the susceptibility of the plants to injury by sodium chlorate in soil following its application for weed control. About 200 determinations of hydrogen-ion concentration were made on expressed plant juices supplied by the Bureau of Plant Industry, but no correlation was found between the measurements and the reported susceptibility of the various plants to chlorate injury.

BIOLOGICAL STAINS

Approximately 45 samples of dyes were examined for the Commission on Standardization of Biological Stains, an increase of about 50 percent over the number examined during the previous year. Work on the development of a quantitative method for the analysis of alizarin red S yielded only negative results. A definite improvement in the method for the analysis of crystal violet was found and is now used in the standard procedure for analysis of this dye.

In addition to the usual requests from the Commission on Standardization of Biological Stains for chemical and spectrophotometric examinations, a large number of requests were received for information and services pertaining to biological stains from various universities and Government and other agencies. Cooperation was continued on the revision of the dye descriptions to be used in the dye monographs for the forthcoming new edition of the National Formulary.

NAVAL STORES RESEARCH

CHEMISTRY AND TECHNOLOGY OF NAVAL STORES (TURPENTINE AND ROSIN)

Fundamental studies on the nature of the acid complexes of pine oleoresin and rosin showed for the first time that both contain dihydro resin acids to the extent of about 3 or 4 percent of the total acids. The dihydro acids can be readily prepared by hydrogenation of pine resin acids and can moreover be easily converted into dihydro lactones. The latter nonacid derivatives, because of their high stability, may eventually become important naval-stores products.

In connection with the fractionation of pine gum, experiments involving separation of the crystalline from the liquid portion were directed toward slow filtration in the belief that such filtration would be economicaly feasible if it is made more or less continuous, self-operating, and coordinated with gum storage, which may become an essential factor for year-round operation at central distilling plants. Three types of multiple-filtration devices, combining simple construction with large filter area and requiring a minimum of attention, were designed and built with that in view. Preliminary tests with these gave promising results. One of the filters, possessing greatest simplicity in construction of the three types, was made for pilot plant-scale experiments. In testing this apparatus, it is contemplated that, in addition to obtaining operating data, a stock of noncrystallizing gum rosin will be prepared from the liquid portion of the gum in order that samples may be supplied to industrial consumers of rosin who have made numerous inquiries concerning this new product and requested samples. Similarly, products from the crystalline portion will also be prepared for industrial testing.

Fundamental studies on the nature of the so-called pyroabietic acid complex, prepared from rosin by catalytic means, showed that, due to a disproportionation reaction, it consists essentially of dihydro-, tetrahydro-, and dehydroabietic acids, each more stable than the original abietic-type acids, and not of isomers of abietic acid, as formerly believed. The dehydroabietic acid, which predominates, constitutes the first significant departure from the relatively unstable hydroaromatic types to the benzenoid type, which, despite its greater unsaturation, possesses a higher stability due to its partially benzenelike character. An isomeric dihydro acid of unusually high positive rotation (108°) was found in the catalytically prepared so-called "pyroabietic acid" complex. In the preparation of "pyroabietic acid" without the aid of catalysts it was found that the principal product is likewise the stable dehydroabietic acid, but in this case the disproportionation mechanism is different in that no tetrahydro acid and no isomeric dihydro acid having a positive rotation of 108° are produced.

Dextropimaric acid heretofore has been regarded as the most stable of all the resin acids in pine gum, and not isomerizable. It was found, however, that upon treatment with cold concentrated sulfuric acid it is isomerized in part to an acid having a negative rotation of 32° in contrast to a positive rotation of 73° for the dextropimaric acid. Dextropimaric acid is also converted by this treatment in part to a neutral product resembling a lactone in chemical properties.

Further investigations have been made on the composition of the nonpinene portion of authentic gum spirits of turpentine distilled from

the oleoresin of longleaf pine. The samples of turpentine used in this investigation were the first (richer in "forerun") and last (richer in "tailings") portions, respectively, of commercial distillations of gum, and were found to contain 0.07 percent of forerun and 7.7 percent of tailings, respectively. Because of the very small quantity of forerun available and its relative complexity, separation into its constituents by fractional distillation was not found possible.

The tailings were subjected to repeated fractional distillation and were found to have the following gross composition: (1) About two-fifths, monocyclic hydrocarbons; (2) about one-fifth, terpene alcohols and phenols; and (3) about two-fifths, principally ethers and esters.

The chemical and physical data of the final series of fractions obtained, when correlated and considered in the order of ascending distillation temperatures, showed the distribution of constituents in the tailings to be somewhat as follows: (1) A small quantity of an unsaturated hydrocarbon having properties similar to p-menthene; (2) considerable dipentene (about one-fourth) which appeared to contain a little d-limonene; (3) a small quantity of terpinolene; (4) a considerable proportion (about one-third) consisting essentially of a mixture—approximately equal quantities—of methyl chavicol and alcohols;[1] (5) a portion (about one-sixth) which was essentially bornyl acetate, but also contained alcohols and a small quantity of alkyl ether; and (6) the remainder of the tailings, containing hydroxy compounds which were in part phenolic, another alkyl ether, and esters other than bornyl acetate.

In this connection fractionating assemblies adapted to vacuum fractionation have been constructed.

In view of the possible use by naval stores producers of oxalic acid to raise the grade of rosin obtainable from oleoresin discolored by iron compounds, attention was given to the results obtained by and the health hazard of using oxalic acid in various ways. The oxalic acid may be placed in the still along with the gum, stirred into the hot molten rosin after straining, or placed in the crude gum before filtration and washing. The last procedure is best because the period of contact is short and the oxalates and unreacted oxalic acid are removed by filtration and washing. With the other methods oxalates remain in the rosin. Moreover, oxalic acid placed in the still may cause isomerization of the resin acids into forms partly responsible for the color in rosin soaps. Rosin produced from oxalic acid-treated gum, which had been filtered and washed before distillation, yielded soap having about the same amount of color as when rosin from the untreated gum was used. The same result was obtained with rosin treated with oxalic acid after straining, but a somewhat darker soap might result from treated rosin kept in molten condition longer than usual. Rosin treated with oxalic acid in the still generally yielded a darker soap than did the untreated rosin. It appears, therefore, that there is no advantage in using oxalic acid to raise the grade of rosin, so far as soap making is concerned.

[1] The alcohols appeared to be a relatively complex mixture. Fenchyl alcohol, one of the predominant alcohols in the tailings of steam-distilled wood turpentine, could not be detected. A solid having the properties of pinocarveol hydrate was isolated, as was also an alcohol which was solid at low temperature and had properties similar to pinocarveol.

The Bureau does not advocate the use of oxalic acid for bleaching rosin, especially by those not engaged in gum cleaning. A mimeographed circular was issued to point out the health hazard attending its use.

Preliminary tests in collaboration with the Industrial Farm Products Research Division of the Bureau on the germicidal properties of soaps made from various rosins, and rosin and resin acids, indicated that a 100-percent-rosin soap and, to a somewhat lesser degree, a 20-percent-rosin soap, have higher germicidal activity than the common fat-acid soaps.

Statistical analysis of the results of comprehensive experiments, in collaboration with the Bureau of Plant Industry, on the growing of plants in paper pots impregnated with copper resinate showed that the copper resinate stimulates plant growth. Impregnation with copper resinate also retards decay of the paper and permits field setting of the entire pot without any deleterious effect on the plant. A public-service patent covering this use of copper resinate has been granted.

Small-scale experiments indicated that the addition of powdered rosin to soil of high organic content exerted a remarkable stimulation on rate of growth and fruit production in the case of tomato plants which were very severely limited in their feeding range and food supply. The experiments are being repeated, with modifications, on a larger scale.

A public-service patent was granted, covering the use of rosin in an expansion-joint filler, as developed in previous work.

The rapidly increasing practice of selling small lots of pine gum to central distilling plants has created a need for standards to be used in grading the gum and methods for determining the turpentine and rosin contents of the crude gum and the grade of rosin that should be produced from it. Samples of crude pine gum were carefully selected by the staff of the naval stores station for use as grading standards. The standard sample for No. 1 gum will make WG rosin; that for No. 2 gum will make K rosin; and that for No. 3 gum will make F rosin. Since these gums must be stored in glass containers and change in appearance due to settling, they can only serve as prototypes. For actual use in gum grading, small panels were painted in oil colors to simulate, as nearly as possible, the appearance of the gum when freshly mixed and placed in museum jars. These secondary standards have been submitted to the industry for trial. The laboratory method previously developed for the testing of pine gum to determine its probable yield of turpentine and rosin, and probable grade of the rosin, was tried out by the largest buyers of pine gum. They reported that this method is superior to any they have tried previously and gives results comparable with those obtained with their large stills.

In connection with the studies on deterioration of turpentine in storage, turpentines of various degrees of deterioration were subjected to tests for aldehydes, peroxides, and acids. Although sufficient data have not been obtained to draw definite conclusions as to the relative value of the different tests, those obtained so far indicate that the peroxide number will be of value as a criterion of the degree of deterioration.

PRODUCTION AND PROCESSING OF NAVAL STORES

Turpentine and rosin producers manifested increasing interest in the possibilities of gum cleaning and steam distillation. These subjects are assuming greater importance because of the progressive development of central stilling as the result of the increasing sales of pine gum by small producers. Steam distillation of cleaned pine gum is especially suitable for extensive plants.

Additional engineering data on the heat requirements for steam distillation have been collected. Such information should be useful in designing large stills and condensers for use in central gum-cleaning and distillation plants.

An experimental steam-and-fire still was built from a 10-gallon aluminum pressure cooker to permit runs on small volumes of gum. Many producers and gum buyers saw the possible value of such equipment for running check charges of gum in connection with gum buying. In response to requests, a drawing of the still was prepared for distribution.

Improvements in the gum-cleaning process were made by simplifying the various steps involved and equipment required. Small-scale equipment for studying problems of gum cleaning is now under construction. This will permit close observation of conditions in each step. Two commercial plants have inaugurated gum cleaning, using an adaptation of the equipment developed at the station.

The improved type of fire still installed at the naval stores station serves as a model for the industry in the field. Additional data obtained in the study of heat distribution in the fire path of the turpentine fire-still setting indicated that slight changes were desirable in flue and fire-path design. This still is operated principally as a demonstration for the benefit of visiting producers, stillers, and others. In addition, the results of runs made on the fire still have constituted an excellent basis for evaluating the results of steam-distillation and gum-cleaning processes, since the fire-still operation is well standardized. Occasionally it is necessary, in commercial practice, to rerun rosin already packaged. Several runs were made on the fire still to determine the decline in grade that may be expected under these conditions. The results indicated that it is possible to make such reruns with a loss not in excess of one grade.

In connection with the collection of gum from the trees a new series of tests was started with turpentine gum cups made of different metals and other materials and some having special protective coatings. As was expected from previous tests, there was very little difference in the effects of the different materials on the grades of rosin produced from the gum collected during the first year, the deterioration being manifested in the second and later years of use. A lot of glass cups made according to the specifications of the Bureau were received and hung. One thousand cups were hung in the Osceola National Forest; 100 in Georgia, and 100 in Florida, on private operations. A special type of hanger for the glass cups was developed. The design of the original glass cup was modified, and cups of this new design will be added to the tests.

In cooperation with the Forest Service, samples of pine gum obtained in experiments to determine the effect upon trees and gum yields of treating fresh-cut streaks with acids and alkalies were ex-

amined in the laboratory. No differences were found between gums from untreated check faces and gums from the treated faces as regards yield and grade of rosin or yield and properties of turpentine. However, further investigations may be made to determine what effects the chemical treatments have on the suitability of the products for industrial uses.

Experiments to determine the extent of losses from uncovered dip barrels showed that there is no appreciable reduction in turpentine yield when the gum is stored for a period of 12 weeks in covered or uncovered wooden or new galvanized-steel dip barrels. The observed loss of gum from some of the wooden barrels was due to leakage and not evaporation. There was a decline of one grade in the quality of rosin resulting from 12 weeks' storage in both kinds of barrel, whether open or closed. Gum in galvanized-steel dip barrels suffers little discoloration if left in the barrel for only about 1 week. The metal barrels are corroded less by slash than by longleaf pine gum.

Further work was done on methods for conditioning turpentine so that it can be stored without loss and with minimum deterioration. Attention was given to the removal of acids as well as all free and dissolved water from the turpentine. Preliminary experiments indicated that the extraction of some of the organic acids can probably be accomplished by washing the turpentine at the still once or twice with water, after which the turpentine may be dehydrated by settling and passing through coarse salt. Studies are being continued to develop the most efficient means of washing turpentine at the still. Equipment for such washing has been designed and will be tried out.

Tests were continued on metal drums of various kinds in comparison with wooden barrels as shipping and storage containers for turpentine. A stainless-steel drum held dehydrated turpentine for 2½ years before the turpentine became unmerchantable because of dark color and high specific gravity. A drum lined with baked lacquer held dehydrated turpentine for 3 years before the color of the turpentine became so dark as to make it unmerchantable. The specific gravity was still within acceptable limits. In both cases the drums were still in good condition. Turpentine was stored in a galvanized drum with a bag of oxalic-acid crystals suspended in it for 2 years before its color became so dark as to make it unmerchantable. Eight to ten months is usually as long as turpentine normally remains in a retail shipping container. In addition to the three containers mentioned, five other drums coated on the inside with various kinds of lacquer kept turpentine in good condition for this length of time. A wooden spirit barrel, thoroughly air dried, glued inside, and painted white on the outside after tightening the hoops, held turpentine without leaking or material deterioration for 15 months, during which it was subjected to frequent handling designed to simulate the treatment received in commerce. This is significant because from 10 to 15 percent of the wooden turpentine barrels now used by the industry for foreign shipments leak by the time they reach the port.

Continuation of the experiments with rosin packages showed that wooden barrels made of ⅞-inch rough or planed pine staves, when stored on end in the open directly on sandy soil, will not last longer than 1½ to 2 years before becoming unmerchantable, requiring breaking down the packages and rerunning through the still or recooper-

ing for marketing. Proper storage on poles in the open approximately doubles the life of the barrels. Galvanized drums which have been sitting on end directly on the ground in the open for 2 years are still in good condition. Tests were started with multiple-ply paper bags for packaging rosin to determine the durability of such packages when stored in the open on boards about 4 inches off the ground and under shelter on a wooden floor in stacks from six to eight bags high.

During the year the naval stores station was visited by 582 persons, including 42 senior forestry students from the University of Georgia who spent 2 days studying equipment and operations.

With assistance from the naval stores station, a complete lay-out and still plant was designed and constructed strictly according to Bureau design. This is probably the first time that a still shed and setting has been built in strict accordance with the Bureau designs, previous plants having been modified to some extent to suit personal preferences of the owner or to meet local conditions.

COOPERATION WITH STATES IN NAVAL-STORES WORK

Educational and demonstration work in connection with the production and processing of naval stores was carried on by cooperative agents in Florida and Georgia.

In Florida 87 naval-stores operators were visited and assisted by the cooperative agent. Under his supervision, 16 new stills were built and 1 was repaired; 1 new still shed was built and 2 were remodeled according to the Bureau's plans; 8 turpentine separators and 6 dehydrators were built; 6 recording thermometers were installed; 1 leaking tail gate was adjusted; 2 sets of rosin strainers were constructed and 4 other strainers were improved. The cooperative agent inspected 2 still thermometers for accuracy, ran 23 demonstration charges, and taught 2 stillers the Bureau's method of regulating distillation by use of the thermometer and graduated receiver for distillate. He also exhibited the tentative standards for gum grading and demonstrated the method of gum grading to producers who sell gum and to processors with the idea of helping them blend gums for desired rosin grades.

In Georgia 151 visits were made to naval-stores producers by the cooperative agent. Under his supervision 11 still settings and 2 still sheds were built; and 17 turpentine separators, 2 dehydrators, and 2 still thermometers were installed. He inspected 9 still settings and 5 dehydrators as to performance and instructed 5 stillers in the Bureau's method of regulating distillation. Test charges were run and assistance was given in gum grading at 9 central stills. Clay and glass gum cups, to the number of 100 of each, were hung in the northern part of the State in connection with the experiments of the naval stores station on cups and for the special purpose of determining relative breakage from freezing.

NAVAL STORES STATISTICS

In compliance with the act of Congress, effective August 15, 1935, which authorizes the Secretary of Agriculture to collect and publish statistics on turpentine and rosin, 2 statistical reports were compiled and published. One gave statistics as of September 30, 1938, and

the other as of March 31, 1939, on production of turpentine and rosin of each class, stocks, exports, imports, and domestic consumption by industries. The first report was issued on November 15, 1938, and the second, on May 15, 1939. The further shortening of time between the closing dates of the statistical periods covered and dates of issuing reports has made the reports more valuable to the naval stores industry. Approximately 5,000 copies of each report, one covering the first half, and the other all of the last naval stores season, have been distributed in response to requests originating in this country and abroad.

FERTILIZER RESEARCH

The investigations in connection with fertilizers and fertilizer materials are primarily intended to promote efficiency in and reduce the cost of producing agricultural commodities by discovering and demonstrating how better and cheaper fertilizers can be made. Incidental to this practical objective, some of the studies on the chemical and physical properties of the numerous elements and compounds which enter into fertilizer manufacture, and on the chemical and biochemical reactions involved in converting elements and compounds into forms assimilable by plants, are exploratory in character and yield new and fundamental scientific knowledge which may be of value in other connections. Since it is equipped with the most up-to-date instruments and devices for physical, physicochemical, and biochemical research, and its personnel is experienced in their use, the Fertilizer Research Division is frequently called upon by other scientific units of this and other Departments to obtain by experiment needed scientific data which they are not prepared to obtain for themselves. A considerable part of this work, therefore, is in collaboration with other Government agencies.

MIXED FERTILIZER INVESTIGATIONS

A statistical study of the average annual crop yields by decades for the 70-year period from 1866 to 1935 for 10 of the principal crops grown in the United States showed that crop yields in the older or eastern part of the country are increasing rather than decreasing, and that the rate of increase is greatest in the section where most fertilizers are used. For the country as a whole, the average yields of all 10 crops increased to a maximum during the fourth, fifth, or sixth decade and then, with the exception of potatoes, decreased somewhat. This decrease, which was particularly marked in the case of corn, was apparently due in part to the upward trend in temperature and downward trend in rainfall for the United States as a whole during the period 1909–36, and in part to the expansion within the past 3 or 4 decades of cultivated areas into the drier and less-productive sections of the Western States.

Further evidence was obtained from experiments with a number of commercial mixed fertilizers that there is less danger of burning crops with most of the high-analysis fertilizers recently introduced than with the low-analysis types. For equivalent applications of plant food, the double-strength mixtures examined had an effect on the concentration of the soil solution that was either equal to or less

than that of the corresponding single-strength mixtures manufactured by the same company.

A complete chemical analysis of 44 representative samples of commercial mixed fertilizers showed that all contained significant quantities of the secondary plant-food elements, such as calcium, magnesium, sulfur, copper, manganese, boron, and zinc, in addition to the three primary plant-food elements—nitrogen, phosphorus, and potassium. Except in the cases of copper, zinc, and boron, the proportions of the secondary elements relative to primary elements was less in double-strength mixtures than in single-strength mixtures. However, the total quantity of secondary elements per ton of fertilizer was about the same in the 2 classes. The principal difference in composition between the 2 classes, other than percentages of nitrogen, phosphorus, and potassium, was the larger amount of acid-insoluble matter in many of the single-strength grades, indicating addition of inert filler in their manufacture.

The proportion of magnesium in high-analysis mixtures relative to the requirements of the average crop was found to be less, as a rule, than that of any other essential plant-food element. The quantities of magnesium and calcium in double-strength mixtures may be inadequate for some crops. Therefore, as much attention should be given to the content of calcium and magnesium as to that of the primary elements in the formulation of double-strength fertilizer mixtures.

Studies in cooperation with the American Society of Agronomy showed that the magnesium in dolomite is about 80-percent available to plants. Dolomite, therefore, may be used as a source of available magnesium in mixed fertilizers, as well as for correcting physiological acidity. Due to the varying reactivity of different-sized particles of the same dolomite, and also to the wide variation in particle size of dolomites similarly ground, it is not advisable to classify dolomites on the basis of the solubility of material ground to pass a screen of any given mesh. The use of such a method may lead to erroneous results.

A method and apparatus were devised and used for accelerating the caking of fertilizer materials and mixtures with a view to comparing their relative caking tendency. The data obtained showed that the tendency of sodium nitrate to cake exceeded that of any other material used in the tests when the moisture content was the same. The difference in the caking tendencies of different fertilizer mixtures was small in comparison with the caking range of fertilizer materials. Caking tendency increased with increase in moisture content up to a certain limit which varied with different materials.

In continued studies on granulation of fertilizer mixtures it was found that an increase in the proportion of an organic ammoniate increases the moisture required to granulate the mixture, thereby also increasing the cost of granulation. Readily soluble nitrogeneous materials, such as urea or ammonium nitrate, differ from the organic ammoniates in that they tend to decrease rather than increase the moisture required to granulate the mixtures in which they are included. It was found that den superphosphate can be granulated at a temperature of 80° C. within a few hours after the acidulation of the phosphate rock, and without any additional moisture.

A study of the granulation of miscellaneous fertilizer materials showed that plasticity and fineness of particle size, rather than content of soluble salts, determines the ease with which a material or mixture can be granulated by the rotary-drying method. The presence of a nonhygroscopic soluble salt in a granulated product tends, as a rule, to increase the hardness of the granule, but a soluble salt is not essential to the formation of fertilizer granules. Dicalcium phosphate, a finely divided water-insoluble material, granulates more readily than does ammonium sulfate or potassium chloride.

In a collaborative study of the official methods for the analysis of phosphatic materials, undertaken on the recommendation of the Association of Official Agricultural Chemists, it was found that slow washing of fertilizer mixtures of the ordinary type gives higher results for both water-soluble and citrate-insoluble P_2O_5 than does rapid washing, because of the formation of free phosphoric acid and fluorapatite by hydrolysis of the citrate-soluble phosphates present. Neither freshly prepared nor cured fluorine-free phosphate mixtures undergo any appreciable reversion during the process of analysis. Freshly prepared ammoniated mixtures that contain a soluble fluorine compound undergo a marked reversion in the process of analysis, but the reversion that occurs in cured ammoniated mixtures that contain fluorine is insignificant if each of the different steps in the process is completed within an hour. A comparison of the MacIntire-Shaw-Hardin method with the official method for determining available P_2O_5 showed that the former method gives higher results than are obtained with the official method in the analysis of basic phosphates, such as tricalcium phosphate, calcined phosphate, and highly ammoniated superphosphate.

POTASH FERTILIZER INVESTIGATIONS

The methods devised during the previous fiscal year for the determination of orthophosphate, pyrophosphate, and metaphosphate in mixtures were used in further studying the products obtained by the action of phosphoric acid on potassium chloride. Equimolecular mixtures of potassium and sodium chlorides heated to 500° and 600° C. with the equivalent phosphoric acid required to produce metaphosphates yielded glassy products soluble in water; under similar conditions but in the absence of sodium chloride, mixtures of phosphoric acid and potassium chloride are largely converted to insoluble potassium metaphosphate. By differential thermal analysis potassium metaphosphate was found to undergo endothermic transitions of 263°, 452°, and 649° before fusion at 807° C., that at the lowest temperature being the only one that was irreversible. As a result and with the exception of the soluble amorphous form produced in small amounts by extremely rapid cooling of the molten salt only insoluble modifications of potassium metaphosphate could be obtained with certainty. In contrast, sodium metaphosphate exhibited only two transitions before fusion, both irreversible; the first at 348° C. being endothermic and the second at 499° C. being exothermic. The modification occurring below the higher transition temperature was only slightly soluble in water, whereas the modification obtained above that temperature and also the glassy product resulting from fusion were both very soluble.

Crude potassium metaphosphate prepared by heating equimolecular mixtures of potassium chloride and phosphoric acid to 800° C. and exposed at room temperature to an atmosphere of 81 percent relative humidity was found to have absorbed only 2.7 percent of moisture and to be free flowing at the end of 30 days.

The reaction between solid dry potassium chloride and liquid nitrogen tetroxide was studied at room temperature under superimposed oxygen pressure of 200 and 1,000 pounds per square inch. The over-all reaction yields potassium nitrate, the desired product, together with chlorine but proceeds too slowly under these conditions to be of commercial interest. Introduction of moisture into the system intensifies the corrosion problem.

Further work was done on the utilization of hydrochloric acid for the production of available phosphates. In the preparation of crude monocalcium chlorophosphate by treating phosphate rock with hydrochloric and phosphoric acids, it was found that the major portion of the fluorine content of the rock was retained in the product, possibly as the analogous fluorophosphate. However, attempts to prepare the fluorine analogue of the chlorophosphate failed to give positive evidence of its existence. The conditions under which monocalcium chlorophosphate dissociates with formation of calcium pyrophosphate were determined by differential thermal analysis.

Crude potassium metaphosphate and monocalcium chlorophosphate were prepared in quantity and supplied to the Bureau of Plant Industry and to the State experiment stations of Idaho, Montana, and Wyoming for use in vegetative tests with several crops under varying climatic conditions on different soil types.

PHOSPHATE FERTILIZER INVESTIGATIONS

The chemistry of phosphates is one of the most complicated and imperfectly understood branches of fertilizer technology, and further progress in the production of cheaper and more efficient phosphatic fertilizers depends primarily upon the establishment of the fundamental relationships between the compounds present in the various systems involved in the production of available phosphates. Additional equipment for a high-temperature phase study of the system CaO-P_2O_5-SiO_2, which is of primary importance in the production of defluorinated phosphates (calcined phosphate and fused phosphate rock) and basic slag, was assembled and used. The investigation, thus far, has been confined largely to the region lying within a triangle with its base on the CaO-SiO_2 side between 35- and 65-percent SiO_2 and its apex at the point representing $Ca_2P_2O_7$ on the CaO-P_2O_5 side of the ternary diagram. Although melting points have been realized with certainty where the primary phase is a binary compound of CaO and SiO_2, considerable difficulty has been encountered deep in the ternary system, where the primary phase is, in general, a phosphate. The almost identical refractive indices of several of the phases makes their identification tedious and slow.

Although superphosphate has been manufactured on a large scale for nearly 100 years, many phases of the chemistry of the complex systems involved therein are still obscure. A complete knowledge of the chemistry of superphosphate will lead, no doubt, to improvements in the manufacturing process and will result in the farmer receiving a

better product at a lower cost. In continuation of the Bureau's investigations, which are producing valuable contributions to the technology of superphosphate, it was found that equilibrium systems obtained by mixing tricalcium phosphate and sulfuric or phosphoric acid afford a convenient reference basis for the graphical comparison of widely different superphosphates. The comparison is based primarily on the degree of acidulation, which is expressed quantitatively by a coefficient of acidulation or corrected acid-rock ratio and which takes into account the acid consumed by the aluminum and iron in the rock as well as the acid value of the fluorine. The results of this study point the way to (1) improved methods for estimating the acid requirements of phosphate rocks, (2) the prediction of the course of the curing processes in any given case, and (3) a favorable choice of conditions for the separate study of the several factors that affect the quality of superphosphates.

In continuation of investigations of the chemical composition of mineral phosphates, analyses of samples from deposits throughout the world showed the presence of 1 to 250 parts per million of acid-soluble arsenic expressed as the trioxide. With domestic materials, the smallest quantities (1 to 12 p. p. m.) were present in Virginia apatite and Florida hard-rock phosphate and the largest (40 to 120 p. p. m.) in phosphates from Arkansas, South Carolina, and certain sections of Montana.

Analyses of samples from cross sections of several phosphate deposits in Idaho and Utah showed that in a given deposit the fluorine contents of the different strata are usually closely related to the phosphoric oxide contents, and that the $F : P_2O_5$ ratios in the higher grades of rock are, in general, close to those previously found in similar grades from deposits in other sections of the country. Samples that contained less than 5 percent of P_2O_5 frequently showed exceptionally high $F : P_2O_5$ ratios.

Greenhouse pot experiments, in cooperation with the Bureau of Plant Industry and several State experiment stations, indicated that calcined phosphate (40-mesh or finer), fused phosphate rock (80-mesh), and the high-temperature form of calcium metaphosphate (80-mesh) are excellent sources of phosphorus for the growth of plants on acid and neutral soils, but give poor results when used on highly alkaline soils. For a given material, a much better correlation of the results of the various experiments was obtained when the fertilizing value of the phosphorus was reckoned on the basis of the increases in the dry weights of the harvested plants than when it was reckoned on the increase in the phosphorus contents thereof.

Because of the failure of phosphoric acid in the ordinary phosphatic fertilizer materials to penetrate soil to any considerable depth and the tendency of soluble phosphoric acid to be fixed by the soil colloids in a form that is largely unavailable to plants, further attention has been given to the comparative value of organic phosphates. It was found in experiments with two types of soil, that the rate of hydrolysis and conversion of sodium glycerolphosphate into an insoluble form increased greatly with temperature. At the highest temperature used (35° C.) all of the organic phosphate was hydrolyzed within 2 weeks and its behavior in the soil thereafter was similar to that of monopotassium phosphate. An extensive study is being made of the be-

havior of other organic phosphates in various soils under a variety of conditions with respect to concentration, sterility, temperature, and oxygen supply.

NITROGENOUS FERTILIZER MATERIALS

In recent years there has been increasing replacement of organic nitrogenous materials in fertilizer mixtures by inorganic and synthetic nitrogen products which cost less than half as much per unit of nitrogen. However, there is still a demand for less expensive organic nitrogenous material, the nitrogen of which will not be lost by leaching but will become gradually available for plant growth. With the object of supplying this demand, experiments were continued on the ammoniation of peat. Different kinds of peat, various preliminary treatments, and various conditions of ammoniation were tried. Of all the ammoniated-peat products prepared, the only ones containing insoluble nitrogen of fairly good reactivity and giving favorable results from nitrification and vegetative tests were prepared by ammoniating peat containing from 25 to 40 percent of moisture at a temperature of 130° C. and a pressure of 500 pounds per square inch. The products obtained from different kinds of peat were very similar under different treatment and the insoluble nitrogen in them showed practically the same activity.

Efforts to employ double compounds of urea and magnesium salts to ameliorate some of the objectionable properties of urea alone for use as a fertilizer resulted in the formation of several double compounds. The most promising of the compounds is $MgSo_4.5urea.2H_2O$, containing about 31 percent of nitrogen, 5 percent of magnesium, and 7 percent of sulfur. A simplified method of preparing this compound consists of heating a mixture of ordinary crystalline magnesium sulfate and urea in theoretical proportions to 60° C., whereupon it dissolves in the water of crystallization, and then adding sufficient alcohol to give a 10-percent alcoholic solution with the released water of crystallization. The double compound separates on cooling.

In efforts to prepare double compounds of urea and acids, no compounds were obtained with metaphosphoric acid but several were formed with organic acids, the most interesting being formyl urea. This unusual compound is formed by reacting urea and formic acid in unimolecular proportions. The formic acid radical attaches to one amide group in urea with elimination of water. The product is a white, finely crystalline compound, slightly soluble in water, containing 31.8 percent of nitrogen, and melting at about 165° C. It shows many desirable properties as a fertilizer material. It is not hygroscopic under ordinary conditions, like urea, and in an atmosphere of 90 percent relative humidity it remained unchanged for 24 hours. In the soil its nitrogen is converted to nitrate almost completely in about 4 weeks, thus giving positive evidence of its plant-food value.

A simple and inexpensive treatment was devised for urea crystals to reduce their tendency to cause caking when used in fertilizer mixtures. It consists of treating commercial crystalline urea containing a few percent of neutral powder with ammonia for a short time at room temperature, whereupon the crystals receive a firmly attached coating of the powder and are made granular and free flowing. The

treated urea will still absorb moisture from the air at high humidities, but on drying returns to the easy flowing, granular condition. The same treatment, with slight modifications, was found applicable also for improving the physical properties of inorganic nitrogen carriers, such as calcium nitrate, sodium nitrate, and ammonium nitrate.

BIOCHEMICAL NITROGEN FIXATION

In further studies dealing with the chemical mechanism of nitrogen fixation by the free-living bacterium *Azotobacter*, special attention was given to the catalytic role of molybdenum. Previous work had shown that the addition of a few parts per billion of this element to an ordinary culture medium commonly increases the fixation of nitrogen about twofold to fivefold. The experimental evidence indicated that molybdenum is essential for nitrogen fixation, but has little or no effect on the utilization of fixed-nitrogen compounds. Work carried on during the year showed even more strikingly the importance of this catalyst in the fixation process, a twentyfold effect being observed in some cases, but there were also indications that under some conditions and with certain types of combined nitrogen, traces of molybdenum hasten their utilization.

Further studies dealing with the mechanism of nitrogen fixation as it occurs in the root nodules of leguminous plants showed that the amount of available carbohydrate that reaches the roots is usually the chief, but not the only, factor that affects nodulation and nitrogen fixation. The inhibition of nodule growth produced by additions of nitrogenous fertilizers is due primarily to the lowering of the supply of carbohydrates to the roots. The carbohydrate-nitrogen ratio of the plant at any given time is of far less importance than the absolute quantity of carbohydrates available for use in nodule growth and nitrogen fixation. The laboratory studies showed that most of the carbohydrate is consumed in the growth of the nodule bacteria and host plant, and is not used to any extent in the fixation process itself apart from growth.

In studies on the metabolism of rhizobia, it was observed that the rate of respiration indicates rather definitely the degree of activity of the organisms. Nongrowing bacteria show a low rate of respiration, whereas the rate of respiration of growing organisms varies directly with the rate of growth. Coenzyme R, the growth factor essential for these bacteria, markedly increased respiration only under conditions where a subsequent growth stimulation occurred. This indicates that there is an interrelation between its effects on the two processes.

Two strains of rhizobia out of a total of 30 tested showed the ability to actively synthesize the growth substance, coenzyme R, and liberate it into the medium. Two other strains synthesized the substance in small amounts. Most rapidly growing rhizobia require additions of coenzyme R to the medium. These recent results are in agreement with previous conclusions as to the necessity of coenzyme R for the growth and respiration of these symbiotic nitrogen-fixing bacteria. Investigations were continued on the isolation and identification of coenzyme R. While it has not been identified, further information was obtained with regard to its properties.

Work was started on composting and closely related methods of converting farm wastes and other organic material into suitable artificial manures as supplements to animal manures and commercial fertilizers.

CATALYST AND HIGH-PRESSURE INVESTIGATIONS

Synthetic ammonia is the principal source of nitrogen in the manufacture of nitrogenous fertilizers. The synthesis of ammonia is effected through passage of a 3:1 hydrogen-nitrogen mixture compressed to several hundred atmospheres over a catalyst at elevated temperatures. The Fertilizer Research Division published a complete set of its own experimental data on the compressibility of four hydrogen-nitrogen mixtures at six temperatures from 0° to 300° C. and at pressures up to 1,000 atmospheres. In addition to the immediate utility of the pressure-volume-temperature relationships, a number of other physical properties such as high-pressure specific heats and expansion coefficients may be obtained by computation. This is being done in the laboratory and should assist in a more accurate control of the process of ammonia synthesis.

In the manufacture of hydrogen for the synthesis of ammonia, carbon dioxide often occurs as an undesirable impurity. It is removed by scrubbing with water under pressure. For this reason it is necessary to know what are the most advantageous conditions for this purification process. The solubility of carbon dioxide in water was measured at eight temperatures from 18° to 100° C. and at various pressures up to 700 atmospheres. It appears that beyond a critical pressure, which decreases with decreasing temperature, carbon dioxide and water are miscible in all proportions. When suitable equipment has been provided this phenomenon will be investigated further.

Research on the kinetics of ammonia synthesis was continued through an investigation of the reverse process, ammonia decomposition. A detailed study was made of the reaction over unpromoted, singly promoted, and doubly promoted iron catalysts. Throughout the range of temperatures used—335° to 430° C.—and with hydrogen-ammonia ratios ranging from 3:1 to 7:1, the rate of decomposition over the doubly promoted catalyst (1.3 percent of Al_2O_3 and 1.6 percent of K_2O) was directly proportional to approximately the 0.7 power of the ammonia partial pressure and inversely proportional to the 0.8 power of the hydrogen partial pressure. The apparent energy of activation throughout the entire range is 43,500 calories. No such regularity was found in the mechanism of the decomposition over the singly promoted catalyst (10.2 percent of Al_2O_3). The dependence of the rate upon the ammonia and the hydrogen partial pressures varied widely with temperature and gas composition. In certain regions the usual kinetics were even reversed, the rate becoming directly proportional to some power of the hydrogen partial pressure and inversely proportional to the ammonia pressure. The apparent energy of activation was very small—in an extreme case even negative. The mechanism of ammonia decomposition over the pure iron catalyst was similar to that over the singly promoted catalyst. The reversed kinetics over the singly promoted and pure iron catalysts is believed to be due to the action of a complex, possi-

bly a nitride, an imide, or an amide which forms and decomposes on the surfaces of the catalysts, depending upon the conditions of temperature and gas concentration.

In the investigation of the chemisorption of gases on iron synthetic-ammonia catalysts, definite proof was found for the first time that the adsorbed nitrogen, hydrogen, and oxygen are in atomic form, whereas the adsorbed carbon monoxide and carbon dioxide are molecular.

Through collaboration of two Bureau scientists with one on a university faculty, a theory has been completed for explaining under one general equation all of the five different types of Van der Waals' adsorption isotherms that are found in scientific literature. This equation permits an evaluation of the surface area of the adsorbent, the average pore diameter in the adsorbent, and the heat of adsorption of the gas in the first and last layers.

FUNDAMENTAL INVESTIGATIONS RELATING TO FERTILIZERS

A method was developed for the quantitative spectroscopic analysis of mixed fertilizer materials for certain important minor-element constituents. These elements are copper, manganese, boron, and zinc. Spectroscopic analyses for the first three of these elements have already given very satisfactory results on more than a dozen mixed fertilizers for which chemical analyses were also available. A rotational spectrum analysis was completed which identifies ultraviolet bands of nitrogen (the so-called A–X bands) as actually belonging to the nitrogen molecule.

From analysis of the experimental measurements of infrared absorption bands arising from the presence of the OH group in several organic molecules, it was concluded that, as a general phenomenon, the OH group, and probably also the NH and CH groups, may exist in more than one stable position of orientation in the molecule, which results in isomeric forms of the molecule differing from one another by the orientation of the group. The work of measuring the thermodynamic quantities pertaining to the nitrous acid equilibrium by means of infrared absorption has progressed and has led to the discovery of what appears to be a new continuous absorption characteristic of one of the components of the system $NO–NO_2–H_2O$. The molecule which is responsible for this absorption will undoubtedly be identified. Nitrogen trioxide and a dimer of nitrous acid both seem to be possibilities at the present stage of the work. Many important and unknown chemical data on this system, which is significant in the production of nitric acid and in nitrogen chemistry generally, can be obtained by studies of absorption in the near infrared.

Methods depending upon differential thermal analysis, X-ray diffraction, and chemical analysis have been devised that are adequate for approximate mineral analysis of clays. Mineralogical information on clay minerals including the micas has been very fragmentary. Structures and causes for polymorphism of the kaolins have now been worked out. A century-old argument has been settled in showing by extensive X-ray-diffraction work that mica exists in many forms, one of which is hexagonal; others belong to the monoclinic

and triclinic crystal systems. This work on micas is particularly important since they are the greatest storehouse of potassium in the soil and methods for making this supply available as a fertilizer will depend upon a knowledge of the way in which the mineral weathers. Results obtained are of fundamental value in that they give an insight into the way in which crystals are built up.

A thermal diffusion method was developed for the separation of gases having different masses and for the separation of isotopes. It works on an entirely new principle involving the diffusion of gases between contiguous streams of gases heated to different temperatures. Special apparatus for carrying out the method was constructed and operated successfully. The results indicated the method to be cheaper and more efficient than any other method now used for the same purpose. The new method can be used for commercial production of gases enriched in certain isotopes which are in demand for the investigation of biological and chemical processes.

CHEMICAL ENGINEERING RESEARCH

AGRICULTURAL FIRES

Field investigations were conducted on a number of selected farms on the Eastern Shore of Maryland and in Chester County, Pa., for the purpose of observing haying practices, types of barns, and the moisture content and heating tendencies of the hay stored. The general practice, in the sections visited, of leaving cut hay in the swath until almost cured does not give as high quality of hay, especially in the case of alfalfa, as when the side-delivery rake is used within a few hours after cutting, but it does lessen handling and reduces shattering to some extent when sudden rains occur before the down hay has cured. The length of cut of chopped hay is very important because it affects the keeping quality of the hay when stored in barns and other containers. Unless the chopped hay is unusually well cured, a cut of 1½ to 2 inches is more desirable than the customary cut of ¾ to 1 inch. The shorter cut results in a denser mass which is difficult to aerate. The old type of bank barn, with the hay compartments extending to the ground level and the lower 8 or 10 feet of the compartments enclosed by solid masonry, appears to be conducive to severe self-heating of the hay in this section of the mow because of lack of aeration and decreased dissipation of the heat produced within the mass.

During the course of the haying period, 31 samples of hay were collected and moisture determinations were made on them in the field, using the distillation method. Included in the collection were red clover, barley, alfalfa, timothy, whitetop, and soybean hays. Investigations were made on both chopped and unchopped hays in storage. The maximum temperature recorded was 58° C. (104.5° F.), in chopped barley hay having a moisture content of 41 percent, 2 days after the hay was stored. The farmer who put up this hay realized that it had not been sufficiently cured and insisted upon having it pitched out on the second day after storage for further curing. On all the farms revisited it was found that the hay had come through the heating or sweating stage in good condition. The results of these field investiga-

tions apparently confirm the findings of previous experiments conducted by the Bureau at Beltsville, Md., namely, that the moisture range for the safe storage of unchopped hay, consistent with good quality, is 25 to 30 percent, while that for chopped hay is 20 to 25 percent. In the latter case the shorter the cut, the lower the moisture content should be for the same quality of the cured hay. Unchopped red clover hay apparently can be safely stored with a moisture content somewhat higher than that for unchopped alfalfa hay.

The results of previous investigation had shown that when undercured alfalfa hay is heated in an inert atmosphere (nitrogen) at a temperature slightly above the limits of bacterial activity, some change occurs which increases the oxygen-absorbing property of the hay. Recent results have confirmed the previous findings. It has been found further that the oxygen absorption increases with increase in time of preheating. The conclusion seems warranted that, in haymows where conditions are favorable to prolonged maintenance of temperatures above normal, the changes that render the hay susceptible to very rapid oxidation and ignition may be due to thermal decomposition. Preliminary experiments in the laboratory indicated that the presence of ammonia also increases oxygen absorption in alfalfa hay.

Experiments with a commercial rat poison indicated that the phosphorus contained therein involves a considerable fire hazard when in contact with a combustible material such as hay or chaff, particularly when moist. A smouldering fire in a barn in Vermont had evidently been caused by contact of this rat poison with chaff which became wet during the night from rain through a leaky roof.

Two members of the chemical engineering staff made a field trip to Texas and other Southern States in order to obtain information on the susceptibility of cottonseed to spontaneous heating and ignition and to ascertain the present situation with respect to cotton-gin fires. The consensus of opinions held by cottonseed-oil mill operators and others appears to be that stored seed having a moisture content of 10 to 12 percent or more will heat dangerously. Specific information was obtained concerning two cases of smouldering and fire in stored cottonseed which definitely indicated that the cause was spontaneous heating and ignition. Investigation was made of two systems for aerating stored cottonseed. One system, employing numerous vertical, triangular-shaped, wooden flues resting on a crackboard floor and extending above the top of the pile of seed was used for naturally aerating relatively small piles of seed. The other system, employing a fan connected to horizontal main ducts with numerous horizontal laterals reposing on the floor level, was used for aerating large quantities of seed. Investigations were conducted at selected cotton gins in north and west Texas and in Mississippi. Conferences were held with numerous officials in regard to cotton-gin fires. Static electricity, matches, and foreign material in the cotton, and friction produced by cotton stuck in the ginning equipment appear to be the main causes of fires in cotton gins. Fire-packed gin bales continue to constitute a serious fire hazard. The modern cotton-gin plant represents a marked advance in design and construction. The building has only one floor level, and is of all-metal construction with a concrete floor. The ginning equipment also is all

metal, and provision is made for artificially drying green, damp, or wet cotton. However, the old-type wooden gin plant predominates throughout the Cotton Belt and will continue to do so for a long period.

In the all-steel gin plant there is still the possibility of considerable damage being done to machinery by warping of metal in case of fire within the equipment during ginning operations. Static electricity creates a fire hazard in cotton gins in two ways: (1) By direct ignition, and (2) by causing the fibers to stand out and be separated so that they are more readily ignited by other sources of ignition. The two factors chiefly responsible for the generation of electrostatic charges in gin plants are climatic conditions, especially when the relative humidity is 40 percent or less, and dirty seed cotton. This dirt in cotton is apt to be chiefly sand and other inorganic material picked up from dust-laden air.

A member of the chemical engineering staff conferred with staff members of agricultural experiment stations and with manufacturers of farm structures on the development of new-type barns for chopped hay, separate and apart from barns for housing livestock. Conferences were held with members of the Industrial Commission of Wisconsin and of the Underwriters' Laboratories on rural fire apparatus, lightning-protection systems, rural electric wiring, and electric fences. The use of a tank truck holding several hundred gallons of water (generally 500) is spreading among rural fire departments in Wisconsin and several other Middle Western States.

The literature on fires in raw and refined sugar has been reviewed and a program has been formulated to be undertaken by a special committee on the investigation of fires in this material which are thought to have been caused by spontaneous ignition.

Members of the Bureau's chemical engineering staff cooperated with organizations interested in fire protection by participating in conferences and meetings, and in the work of committees on which they held membership. These organizations included the National Fire Protection Association, the national fire waste council of the Chamber of Commerce of the United States, the American Society of Agricultural Engineers, and the National Safety Council.

DUST EXPLOSIONS

Thirteen major explosions in industrial plants, involving dusts from agricultural materials, were investigated by the Bureau. Nine of these were caused by grain dust, 2 by malt dust, and 1 each was caused by dusts of fertilizer and gluten meal. These explosions resulted in the death of 10 men, injury to 32, and property damage amounting to about $3,927,000.

The outstanding dust-explosion loss of the year and, in fact, the largest or second largest loss of this kind on record, occurred on May 11, 1939, in Chicago when 5 large grain elevators were destroyed. In this explosion 9 men were killed, 30 were injured, and the property loss was $3,500,000. With the exception of this major explosion, there was only 1 loss during the year which exceeded $100,000, indicating that many of the industries subject to the dust-explosion hazard have succeeded in segregating the more hazardous units in

their plants or have provided means of releasing explosion pressure before it builds up to the point where structural damage occurs. For some time it has been realized that grain-handling plants require special attention in providing protection against dust explosions. In new plants it has been possible to install safeguards against explosions and fires, but there are still many grain-handling plants in the country similar to the elevators destroyed with such a heavy loss at Chicago. These plants of frame construction are quickly enveloped in flames when an explosion occurs and the fire is frequently beyond control before firemen reach the scene.

Laboratory studies were continued on the effect of particle size on the explosibility of dust. The air elutriator is being used to obtain samples of dust of very small particle size for testing in the explosibility apparatus. Fractionation of cellulose has been carried on in this series of tests, yielding three fractions finer than any previously obtained with screens in the course of this work.

The abstract literature on dust explosions has been reviewed and summarized from 1926 to recent date. A search of technical and trade literature has also been made for instances of explosions in the handling of carbon disulfide, commonly used for killing weevils in grain.

Forty-seven samples of dust were tested in the laboratory for explosibility. The following materials were found to form explosive mixtures with air: Fertilizer dust, walnut-shell flour, synthetic resins of two types, cocoa, malt dust, carbon, pitch dust, zinc stearate, accumulated dust (mostly zinc stearate and aluminum stearate), dried blood, alfalfa meal, sawdust-sand mixture (floor-sweeping compound), insecticide mixtures containing walnut-shell flour, derris, and wheat flour.

The results of the Bureau's work on prevention of dust explosions were presented at firemen's training schools and conventions of firemen's associations and at meetings of various other organizations.

In connection with their work on dust-explosion prevention, members of the chemical engineering staff cooperated with national organizations by participating in the work of committees on which they held membership. The dust explosion hazards committee of the National Fire Protection Association, of which the Chief of the Chemical Engineering Research Division is chairman, was assisted in the preparation of safety codes for the prevention of dust explosions in sulfur plants and aluminum manufacturing plants. The same organization was also assisted in the preparation of a safety code covering the installation and operation of air-conditioning systems and blower and exhaust systems for the handling of dust, stock, and vapor. The American Standards Association was assisted in the preparation of a code for the safe installation and operation of different types of conveyors. The Chief of the Chemical Engineering Research Division, as vice president of the National Fire Protection Association, assisted in the preparation of programs and the outlining of projects designed to reduce fire and explosion losses. Conferences were held with representatives of companies interested in fire and explosion prevention concerning the development of devices or equipment to provide protection against these hazards. The total number of publications and addresses on dust explosions and related subjects was 18.

SERVICE WORK

The Chemical Engineering Research Division served as the contact between the Plans and Service Division and the regional research laboratories organization in the preparation of drawings and specifications for the four regional laboratories. Considerable preliminary work had to be done before working drawings and specifications could be prepared for the buildings. Two members of the Division made a comprehensive survey of eight large industrial research laboratories for the purpose of studying features of design and construction, facilities, and equipment. Many of the features decided upon for the regional laboratories were previously incorporated in the plans for the three departmental laboratories being erected at the Agricultural Research Center at Beltsville, Md. This afforded an opportunity to give the model chemical laboratory layout further study in its application to a modern air-conditioned laboratory building. Standard laboratory equipment was designed for the regional laboratories which will also be used for the departmental laboratories at Beltsville.

Particular attention was given to the design of the fume hood, whereby used air from the air-conditioning system will be delivered to the hood, instead of drawing conditioned air from the room. Each hood will operate independently from all others. Tests were made with a working model to be assured of satisfactory air flow and operation. Occasional tests were made of materials for the purpose of selecting a particular material of construction for resistance to definite exposures. Small-scale and occasional full-scale models were developed to facilitate decisions. A fund of information, to be drawn upon in the planning work, was assembled by contacts with industrial concerns.

Plans and estimates were made and specifications written for all the principal items of the mechanical shops. Equipment lay-outs were also developed for the library, chemical stockroom, mechanical stores, and general services for the laboratories.

The pilot-plant wing of each laboratory was given a great amount of study. The proposed industrial-alcohol unit for the Northern Regional Laboratory was discussed with those interested and preliminary sketch plans were twice prepared in order to include certain features and rearrangements of equipment.

Most of the divisions of the Bureau were assisted by the preparation of designs and specifications for laboratory equipment and by drafting work, including graphs, charts, diagrams, drawings, curves, signs, and lettering. The regular quarterly fire inspections of the Bureau offices, laboratories, and storage spaces were made by members of the Division.

ARCHITECTURAL AND ENGINEERING SERVICE WORK

The principal activity of the Division of Plans and Service concerned plans for the four regional research laboratories, establishment and organization of which are discussed elsewhere in this report. On the basis of needs established by the Special Committee on Regional Laboratory Plans and Specifications, this Division prepared detailed plans and specifications after first studying with the

scientists the physical factors determining the actual architectural and engineering designs. Among the factors evaluated in this study were: (1) The type of architecture that would most suitably express and house the research functions of the laboratory and which would at the same time meet the local conditions, accommodate itself to the physical requirements of the building, and harmonize with the architectural atmosphere of the particular locality in which the laboratory is located. (2) The foundation conditions including the type of soil encountered; its bearing value; the subsurface water conditions; the presence of rock or the need for pile foundations or the need to provide against stresses due to earthquakes. (3) The determination of the available supplies of water, together with its chemical analysis and available pressure; the supply of gas, together with its British thermal unit content and available volume and pressure; the sewer capacity for storm and sanitary drainage, together with the present flow, the probable future flow and the available surplus capacity to accommodate the laboratory; the available supply of electric power including the voltage at which most economical metering could be supplied; the available railroad or other delivery for fuel and the topography of the site upon which the building would rest. (4) The probable demand by the laboratory for steam at various pressures; for vacuum; for compressed air; for gas; for hot water; for cold water; for distilled water; for soft water; for electricity at a number of different voltages, amperages, cycles, and phases in alternating current and direct current. (5) The climatic conditions by which would be determined steam requirements for heating and hot water, refrigeration, and ventilation requirements for air conditioning. (6) The orientation of the buildings from which to determine the sun load of heat and the prevailing wind directions by which to design suitable zone controls of heating and air conditioning. (7) The preparation of suitable budgetary estimates of costs by which to control the costs of the design.

The actual design of the 4 laboratories required the services of a force of 170 architects and engineers of various kinds, estimators, draftsmen, and assistants. The architectural force included men talented in the field of design for architectural appearance and for creative design, delineation, and the preparation of suitable renderings by which to coordinate all the factors entering into the general design composition. There were also among the architects those skilled in the practical details of construction, those experienced in the selection of materials and methods of workmanship, and the preparation of suitable specifications, delineating such materials and workmanship so as to keep costs within prescribed limits. The structural engineers were required to meet foundation requirements varying from a soft marsh requiring the use of long piles to bedrock requiring blasting in order to obtain suitable bearing value to support the building. The site engineers determined the availability, location, and accessibility of all utilities including electricity, storm and sanitary sewers, water supply, telephone, gas, and fuel, as well as the configuration of the land upon which the building rests. They were required also to prepare drawings indicating suitable grades and slopes around the building, together with roads and walks for

access to the building and suitable parking areas. The mechanical engineers produced designs covering illumination, electric wiring, transformers and electric substations, power plants, refrigeration, sanitation, water purification, heating, and air conditioning.

In the design of the heating and air conditioning, it was determined to be economical to use double windows with heat-resistant glass where exposed to the direct rays of the sun and insulation against the exterior walls and the ceiling of the upper floor. In the design of the air conditioning a special condition is encountered in the laboratory rooms because of the use of at least one fume hood in each laboratory room. In order to reduce operation costs the design of the ventilation system provided that the usual quantity of discharged air, replaced by a like quantity of fresh air taken in from the outside, should be used to ventilate the fume hoods and remove from them all noxious gases and odors. This is accomplished by an ingenuous arrangement of ducts, automatic dampers, and fans which supply an exact amount of fresh air to each fume hood regardless of how many or how few of them may be in operation at a time.

There will be about 15 acres of usable floor space in the four laboratory buildings, and about 5 acres of roof. There will be about an acre of windows to furnish outside light to the buildings, which will involve the use of about one-half acre of heat-resistant glass and about 1½ acres of window glass. The foundations of the southern laboratory require the use of about 30 miles of wood piles. The design of the western laboratory requires the use of special reinforced poured concrete construction for exterior and cross walls and floor and roof slabs to insure that the building will withstand earthquakes.

In addition to the design of the regional laboratories, the work included a large amount of design work covering buildings of many different kinds and classes in a number of different sections of the United States. A list of the more than 100 jobs handled would occupy more space than can be given in this report. The estimated total cost of these projects for design and construction, including the 4 regional laboratories, amounted to a little less than $15,000,000.

Included in the buildings designed, of particular interest are a film-storage vault for the storage of inflammable moving-picture film, departmental laboratories at the Agricultural Research Center, and greenhouses and palm house at the horticultural station at Beltsville affording approximately a quarter of a million square feet of greenhouse space, as well as numerous projects covering the many phases of architecture and structural, site, sanitary, plumbing, heating, air-conditioning, and refrigeration engineering. Of special interest is the $500,000 plant-quarantine building at Hoboken, N. J.

FARM-STRUCTURES RESEARCH

Research directed toward the improvement and economy of farm structures and equipment covered a variety of activities principally related to problems of farmhouse design and remodeling; storage of small grain, corn, and potatoes; design of silos for holding grass

silage; design and operation of orchard heaters; problems in the transportation of farm products; and investigation of various factors in livestock shelters.

FARMHOUSES

That the study of farmhouse problems is of high importance is indicated by estimates that there are about 7¼ million farmhouses in the country, valued at more than $7,000,000,000, or about 15 percent of the value of all farm real estate. Surveys have indicated that in general farmhouses are much below desirable standards, that hundreds of thousands are in need of replacement, and a high percentage are in need of repairs and remodeling. That there is much interest in the problems of building and remodeling farmhouses is shown by the fact that nearly 90,000 requests were made for one or the other of 2 Farmers' Bulletins, 1738, Farmhouse Plans, and 1749, Modernizing Farmhouses.

In addition to its work of preparing publications and answering direct inquiries the Bureau is carrying on 2 research projects on various problems of design and construction of farmhouses, 1 under northern conditions in cooperation with the University of Wisconsin, and 1 under southern conditions in cooperation with the University of Georgia. The object of the Wisconsin work is to find out what improvements in their houses farm families find most worth while and how they may best utilize their own resources in getting them. The studies were begun in the houses of farmers who were planning to make improvements, and continued during and after construction. Descriptions of the manner in which this research is carried on have appeared in previous annual reports of the former Bureau of Agricultural Engineering. The results of the work cover so far a total of 10 old houses, 6 houses after remodeling, and 2 new houses. In each case the owners of new or remodeled houses are well satisfied with the planning and the innovations in use of material and equipment. Experience to date has shown that the method followed is one of the most direct and reliable ways of solving many of the farm-housing problems. It enables the cooperating owners to carry out the improvement work under expert direction. The finished houses serve to stimulate a large amount of repairing and remodeling of other farmhouses in the locality.

At the University of Georgia, engineers of the Bureau and the university have constructed eight small test houses, representing different types of construction using various materials common to the South. The foremost factors for consideration in this work are comfort, durability, and economy. The tests so far have led to a number of important conclusions regarding the maintenance of summer comfort in southern farmhouses. Among these conclusions are:

(1) Contrary to prevailing opinion in the region, houses with high ceilings as customarily built do not appear to be any more comfortable in summer than those with ceilings of average height. This suggests the possibility of lower cost without sacrifice of comfort.

(2) Loosely constructed houses which permit considerable air movement within the walls, over the ceilings, and under the floors are generally more comfortable in summer than those tightly constructed,

but are decidedly more uncomfortable in winter even when using excessive amounts of fuel.

(3) Ceiling insulation of tightly constructed houses aids in keeping out solar heat, but this advantage is offset to some extent by the fact that heat from cooking is kept in unless ample ventilation is provided.

(4) Ordinary gable ventilators in the attic were found relatively ineffective and indications are that better means of ventilating houses must be devised if summer comfort is to be much improved.

Cottonseed hulls, a widely available waste product in the South, were used successfully in these houses for insulation. The hulls were made fire-resistant by a simple treatment which farmers could apply at low cost.

The various tests on the experimental houses during the winter show the value of simple, economical precautions in improving comfort and reducing fuel consumption. For example, calking of a loosely constructed house to approximate the effect of building paper in the walls and weather-stripping resulted in fuel savings of 15 to 45 percent. Closing up the spaces between the supporting piers of some of these houses reduced the heat loss through the floors and, together with calking, saved as much as 60 percent of the fuel.

The problem of building a house that will be as satisfactory in winter as in summer, without resorting to mechanical cooling in summer, has not yet been solved. The investigators commented that none of the standard methods of construction appear to be entirely satisfactory. It seems likely, however, that a type that permits air movement under the floor and in the wall and attic spaces in the summer but shuts this off during winter can be designed and will improve farmhouse comfort in the South to a considerable extent. Materials used in the construction of these test houses were selected with such qualities in mind as fire resistance, durability, and resistance to the attack of insects and rodents. Those materials include ordinary type of lumber construction; precast-concrete slabs for walls, sills, piers, and steps; metal as wall and roof covering; and stucco on metal lath that has been back-plastered to form a wall. The primary difficulty has been to meet the requirements of low cost, but it looks as if a number of these types of construction can be used satisfactorily and economically, since much of the work can be done with farm labor.

During the coming year studies will be made on various other methods of house and attic ventilation, and it is proposed to make studies in a limited number of occupied farmhouses which will be improved by the owners as a means of more thoroughly investigating various other aspects of farmhouse planning and construction.

APPLE STORAGE

Modern trends of motor transportation have introduced several new problems relating to apple storage on the farm. At present most farm storages are air-cooled storages which give only moderate success unless properly located as to climate and efficiently operated.

Studies have been made in Virginia and a manuscript for a bulletin prepared showing existing practices and giving suggestions for improvement of structures and methods of management.

POTATO STORAGE

Following the research on potato storages in Maine, which was productive of improved design from the standpoints of saving potatoes and of the durability of the structure itself, work of a similar nature has been carried on in Michigan and North Dakota and further studies will be made in Nebraska the coming year. The work in North Dakota has been continued, but the Michigan studies are practically over except for periodical inspections of storages that were designed or remodeled in connection with this project. As a result of the Michigan work, storages incorporating principles of moisture control have been designed and plans are being made available to farmers. Because of the great variation in acreage of potatoes on individual farms in that region and because most of the potatoes grown there are stored on farms, a large range of sizes of storage houses has been provided in the designs. These recent studies have brought out ways of controlling condensation of moisture on ceilings. It was found for example that in bank storages humidity can be controlled by permitting condensation on the ceiling and disposing of the condensed water.

Box storage of potatoes resulted in less shrinkage and a higher grade of potatoes than bulk storage, but the cost of boxes tended to offset the advantage. The common practice of grading potatoes at the time they are put into storage was found less desirable than storing the potatoes without grading. Handling the potatoes in grading operations apparently produced injuries that caused deterioration.

SILAGE-PRESSURE STUDIES

Because of the rapidly increasing use of green crops other than corn for silage, studies of side-wall pressures exerted by different kinds of silage under varying conditions have been carried on by the Bureau in cooperation with the New Jersey Agricultural Experiment Station. The evidence collected shows that grass silage may exert considerably greater pressure than corn silage. Analysis of the data shows that the pressure on the silo walls is affected by moisture content of the silage and the diameter of the silo as well as by type of silage and the depth to which the silo is filled, but further studies are needed to provide a fully satisfactory basis for safe and economical design.

In handling green hay and grass silage excess juice is often a problem resulting in leakage through the silo walls with accompanying odor, mud, unsightliness, and probable deterioration. In two tests, drains placed through the foundation of the wall were effective in carrying away much of the excess juice from hay and molasses silage and from hay and acid silage.

CORN STORAGE

Experimental work on corn storage was carried on at Ames, Iowa, Urbana, Ill., and at the Arlington Experiment Farm in Virginia. This work was closely coordinated with a survey of corn storage on farms, under an allotment from the Bankhead-Jones special research fund, in the principal corn-growing States. These coordinated studies were planned to be as helpful as possible to the Agricultural Adjust-

ment Administration and Commodity Credit Corporation in the corn-loan program, as well as to help solve farmers' corn-storage problems.

The tests at Ames covered more than 20 types of storages for ear corn. While the 1938 corn crop was one of the driest on record and no critical storage conditions occurred, investigators obtained valuable information on structural and ventilation characteristics from various cribs. Similar tests on 8 cribs were made at Urbana. Where samples were taken from a crib with an ear-corn probe made of ¾-inch pipe the corn around the opening made by the probe dried faster than that in the rest of the crib. A test was carried out by making many probe openings in an entire crib. The improvement in rate of drying was encouraging and indicated that this method may be of value in soft-corn years. The 3 corn crops since this storage study was started have been above average in quality and there has been no opportunity to study soft or frosted corn which constitutes the most serious problem in corn storage.

A relatively new development in farm storage of corn was the shelling of ear corn at the end of the first year and storing in tight bins, which results in economy of space and protection against damage by rats and mice, and affords opportunity to fumigate for protection against insects. The Bureau studied this practice and believes it to be sound provided certain safeguards as to moisture content of grain and bin construction are observed. The Commodity Credit Corporation recently ordered about 41,000 bins for such storage.

A research project is under way to determine safe dimensions and ventilation requirements for corn-storage structures in various localities. Information of this kind is of basic importance in determining the eligibility of farm storages for Government loans. To this end weather data are being analyzed, many cribs in different localities have been sampled periodically, and large numbers of ears of corn of different varieties, sizes, and degrees of maturity have been weighed to determine the effect of weather on the rate of drying and moisture content throughout the storage season.

The Weather Bureau provided much detailed information on temperatures and vapor pressures. The investigators are relating this information to the corn-moisture and drying rates observed in field and laboratory studies and the combined information will be used to lay out more accurate geographical zones on a basis of desirable widths and ventilation requirements for corncribs. These more accurate designations will be of particular value in years when the corn crop is not well matured since cribs of proper width for the locality provide the most economical safe storage.

A special survey of corn storage on farms covering 6 counties in Iowa, Minnesota, and Indiana was conducted during September and October 1938, and included 294 cribs containing corn of the 1937 crop under an allotment of Bankhead-Jones special research fund. The information was furnished the Agricultural Adjustment Administration for use in setting up storage regulations for loans on the 1938 crop. Further studies were made on corn of the 1938 harvest and some held-over ear corn and shelled corn of the 1937 harvest in 11 selected counties in Iowa, Minnesota, Illinois, and Indiana. In most of the counties corn was much drier than usual and there was less than the

ordinary amount of loss due to moisture. However, there was a large amount of damage to ear corn by rats and mice and some damage by insects in all of the counties studied.

The 1937 shelled corn, which went into storage in good condition, suffered practically no damage. The surface layer of corn in some cases took up more than 4 percent of moisture during the winter but soon dried out again with the coming of warm weather.

WHEAT STORAGE

The studies of wheat storage under the Bankhead-Jones special research fund were continued.

The wheat-handling problem differs markedly from that of handling corn in that practically all the wheat leaves the farm as such, whereas most of the corn is fed on the farm. However, a considerable part of every wheat crop is stored on the farm temporarily and under crop-adjustment procedure reserves will be carried on the farm for a longer period, as, for instance, in 1938 when about 40,000,000 bushels were sealed in farm storages under the ever-normal-granary program. These new conditions in the handling of wheat emphasize a need for better storage and for means of artificial drying adapted for farm use.

The fact that the Bureau now has in storage wheat from a number of crops, including those of all years from 1935 to 1939, most of it in good condition, indicates the practicability of season-to-season storage on the farm when suitable wheat and the right type of bins are available.

Information gained in the early part of the storage investigations formed the substance of a bulletin issued by the Agricultural Adjustment Administration, Wheat Storage in the Ever-Normal Granary. Circular 544, Methods of Ventilating Wheat in Farm Storage, contains information on the advantages and limitations of ventilation in wheat storages on the farm.

Two experimental wheat driers were built and tested during the past year in drying newly harvested wheat on farms. One of these when handling 100 bushels per hour removed from 1½ to 2½ percent of moisture from new wheat that had a moisture content range from 14.75 to 17.25 percent. Fuel costs for both drying and the mechanical operation of the machine ranged from one-fourth to one-half cent per bushel for each percent of moisture removed. The machine was designed especially for handling wheat which cannot be stored safely because it has 1 or 2 percent of moisture above the safe maximum.

The other drier which was built in cooperation with the University of Maryland is so designed that the amount of moisture removed is determined by the time the grain is left in the machine. Decreasing the capacity in bushels per hour increases the percent of moisture removed. For example, when wheat of 18.9-percent moisture went through the machine at the rate of 24 bushels per hour 7 percent of moisture was removed. When the rate was stepped up to 40 bushels with wheat of 19.5-percent moisture, the moisture content was reduced 4.1 percent. In general with this machine wheat containing too much moisture for safe storage can be reduced to 13-percent moisture content at rates of from 25 to 100 bushels an hour. The same machine

has been used successfully in drying seed barley which had been treated for smut by the hot-water method. These machines work satisfactorily, but simplification is needed to cut their initial cost.

GRAIN SORGHUM STORAGE

Because most of the grain sorghum is harvested in the late fall when its moisture content is often above 13 percent, farmers generally consider this crop harder to store than wheat. In an attempt to overcome some of the difficulties, the Bureau, with money provided from the Bankhead-Jones special research fund, carried on storage studies with experimental bins and made surveys on farm storages and collected experiences of farmers. Sixty farms were visited and records made of the condition of the grain in March and again in June.

Since the 1938 crop was harvested under unusually dry weather conditions, practically all of the sorghum had less than 13 percent of moisture. Little change in this respect occurred between March and June. Samples from bins as much as 4 years old substantiated farmers' claims that grain sorghum stored in a dry condition offers no unusual storage difficulties in comparison with wheat. The more cautious farmers use corn binders for harvesting and thresh after the grain has become sufficiently dry. However, farmers who use combines and harvest only when the grain is dry experience little difficulty with moisture in the stored grain.

Where there is insufficient storage space the sorghum is often headed and the heads are stored outside in ricks, but the survey showed that by June there was severe weevil infestation in the grain so stored and practically no damage to that stored inside. The grain stored outside or in loosely constructed barns was also badly contaminated by dust in areas where dust storms had occurred. The investigators concluded that outside storage should be considered at best only a temporary expedient, and recommend threshing as soon as moisture conditions permit and placing the grain in bins. Fumigation is not commonly practiced, but the survey indicates it is generally necessary for successful long-time storage.

In addition to the surveys, 2,200 bushels of sorghum was stored in experimental bins and periodic observations were made on the condition of the grain.

Two types of bins using the force of wind to produce ventilation gave good results in drying grain sorghum and are economical in construction. With an initial moisture content of 13.9 percent, one type resulted in a reduction of 2 percent and the other a reduction of 3 percent of moisture. No drying occurred in a tight bin of similar grain.

ORCHARD HEATERS

Heating of citrus orchards in California has been done mostly with oil burners of the so-called vaporizing or distilling types which have not proved entirely satisfactory because of excessive smoke production when cold weather requires the burning of large amounts of fuel. During such a period in the winter of 1937, smoke caused much damage to household goods and even became a menace to health and traffic. Starting out with extensive experience acquired in studies of other oil-burning heating equipment, Bureau engineers

built experimental atomizing-type burners for the burning of the heavier oils. One development is a pressure-atomizing type requiring oil at 75 to 100 pounds pressure per square inch, supplied through pipe laid in the orchard. The other is an air-atomizing type which uses compressed air at relatively low pressures. Tests showed these burners, using reasonably heavy fuel, produced virtually no smoke.

Although the atomizing burner seemed to operate better, installation costs were measurably greater than for the simpler distilling type, and the problem of distributing the air and oil to the scattered burners has not been satisfactorily solved. Improvements which reduce smoke have been devised for the distilling type, but it is not expected that they will be completely successful in burning the heavier fuels.

FIREPLACE CONSTRUCTION

A survey was made of a large number of fireplaces to determine the best design to reduce smoking and increase efficiency. Tables based upon these studies will be prepared for publication in bulletin form.

FARM-BUILDING PLAN SERVICE

Through arrangements with the Extension Service in cooperation with the State agricultural colleges, the Bureau carries on a farm-building-plan service designed to provide farmers with plans for economical farm buildings and equipment adapted to the different regions and States.

In addition to the various farmers' bulletins, leaflets, and circulars on construction of farmhouses and other farm buildings, the Bureau and the cooperating agencies have been preparing regional plan books covering plans of a variety of structures, including farmhouses, barns, storages, and many kinds of equipment, which are placed in the hands of county agents and with State extension workers where they serve as catalogs from which farmers may select the plans needed. The working drawings are obtained at small cost from the State extension service. During the year such a regional building-plan book was issued for the Western States, and another was prepared for the Southern States and submitted for publication. Earlier a similar book was prepared for use in the Northeastern States. These plan services lessen the load on the Bureau in supplying plans direct to farmers, which formerly involved considerable time and expense. They also make complete plan services available to States that formerly lacked such facilities.

Information was collected on the lighting of farm buildings, the need for which has become more apparent with the rapid increase in rural electrification. There are now almost 1½ million farms having access to electric power-lines. A manuscript for a Farmers' Bulletin, Electric Light for the Farmstead, was prepared by the Bureau in cooperation with the Bureau of Home Economics and outside agencies, including the Illuminating Engineering Society.

Information was compiled on farm fences and a manuscript prepared for a Farmers' Bulletin which was submitted for publication.

Technical assistance was given in the design of special livestock structures and laboratories costing about half a million dollars which are now being built at the Agricultural Research Center.

TRANSPORTATION OF FARM PRODUCTS

A test made in cooperation with the Bureau of Plant Industry on a shipment of oranges from California to New York verified previous results which showed that savings can be made in shipping cost by using ice in the upper half only of the bunkers in refrigerator cars. The saving in ice averages 20 percent over the cars with normally iced bunkers.

Engineers of the Bureau reported further progress in the development of the electric-type anemometer for use in measuring low air velocities in inaccessible places in storages and railroad cars for fruits and vegetables. They worked out a means for using a number of these instruments having the same current adjustments at different locations in the car, which makes it possible to obtain readings of air movement at different points almost simultaneously. This sensitive instrument enables investigators to measure air movement at very low velocities in studies of refrigeration, ventilation, and heating.

FARM MECHANICAL EQUIPMENT RESEARCH

Studies of mechanical equipment, directed toward the improvement and development of crop-production and processing machines and better methods of using them, are constantly being made by the Bureau. This includes basic research on the requirements of machines for more effective tillage of the soil and more efficient handling and processing of the crops. With the new Bureau set-up, which includes chemistry and engineering under one head, work on mechanical-equipment problems which have arisen as a result of uncovering new uses for farm products can be more closely correlated.

PEST-CONTROL MACHINES AND METHODS

Cutting crop losses through better equipment for pest control has long received attention as one of the important means of increasing returns. Work in this field during the year has had to do with corn-borer control, machines for control of other insect pests and plant diseases, and weed control. In most cases this work has been carried on in cooperation with other bureaus and with State agricultural experiment stations.

Further improvements in design to effect better performance and increase durability were made on the self-aligning disk-jointer attachment for plows, a device worked out in the Bureau as one means of getting better coverage of cornstalks and therefore better control of the European corn borer. Improvements were also made in the trash-covering attachment which helps to gain this same result. Both of these devices can be attached to almost any make of wheel plow. These changes were found necessary because (1) the problem of cutting through and covering trash in the plowing operation has greatly increased with the advent of the combine harvester, which spreads loose trash over the field frequently in a badly bunched condition, and (2) the recent introduction of hybrid varieties of corn having ranker stalk growth and heavier root system has brought about more difficult conditions in the problem of trash coverage.

Two identical experimental wheelbarrow power sprayers were constructed for spraying sweet corn for borer control and were tested out

with a number of insecticides. The cooperating entomologists found that liquid sprays applied with this equipment, at the rate of 150 gallons of spray per acre, were more effective than insecticidal dusts applied with a commercial duster powered by a ½-horsepower engine and mounted on a chassis similar to that used for the wheelbarrow sprayer. The quantities and costs of insecticidal materials used per acre and the effectiveness of the materials applied by the two methods are shown in the tables 1 and 2.

TABLE 1.—*Quantities of spray materials used, cost per acre per application on Golden Cross Bantam Corn and percentage of borer-free ears*

Agent	Quantities used per acre per application[1] (150 gallons of spray)	Cost			No. 1 ears, borer-free
		Agent	Spreader	Total	
		Dollars	*Dollars*	*Dollars*	*Percent*
Phenothiazine	6 pounds	3.60	0.32	3.92	79.90
Calcium fluosilicate	9 pounds	.90	.32	1.22	92.96
Calcium fluosilicate, bentonite clay.	9 pounds+3 pounds	0.90+ .06	.32	1.28	97.46
Sodium fluoaluminate	3 pounds	.32	.32	.64	88.78
Sodium fluoaluminate, bentonite clay.	3 pounds+3 pounds	.32+ .06	.32	.70	96.00
Potassium fluoaluminate, bentonite clay.	do	(2)	.32		95.85
Tank-mixed nicotine, bentonite clay.	1.95 pints nicotine sulfate+6 pounds.	1.83+ .12	.32	2.27	80.50
Dual fixed nicotine	6½ pounds	1.56	.32	1.88	75.61
Nicotine tannate (standard)	1½ pints free nicotine (50 percent)+4½ pints gallotannin.	1.62+1.17	.32	3.11	75.00
Quebracho nicotine tannate	18 pounds	2.70		2.70	81.07
Ground derris	6 pounds	2.64	.32	2.96	98.06
No treatment					55.14

[1] 0.625 pound of spreader used in all except quebracho nicotine tannate to which no spreader was added 4 applications made.
[2] No price available.

TABLE 2.—*Quantities of dust materials used, cost per acre per application on Golden Cross Bantam Corn and percentage of borer-free ears*

Agent	Quantity used per acre per application[1]		Cost			No. 1 ears, borer-free
	Insecticide	Carrier	Insecticide	Carrier	Total	
	Pounds	*Pounds*	*Dollars*	*Dollars*	*Dollars*	*Percent*
Dual fixed nicotine	50	0	7.25	0.00	7.25	75.11
Ground derris	4	16	1.76	.20	1.96	71.43
Calcium fluosilicate	5½	16½	.55	.21	.76	67.29
Potassium fluoaluminate	6⅔	23⅓	.67	.32	.99	66.04
Bancroft clay		40		.50	.50	49.10
No treatment						34.31

[1] 4 applications of dust were made, June 26, June 30, July 7, and July 12.

Power sprayers of the wheelbarrow type designed by this Bureau have already been placed on the market by one commercial manufacturer.

The Bureau has set up apparatus for investigating performance of dust nozzles, since one important need is for uniform distribution of insecticidal dust for effective and economical control of insects. Many of the machines studied did not deliver dust equally from various nozzles nor uniformly from individual nozzles, and alterations are being made which it is hoped will cut costs of materials to farmers

and improve control. Further tests of the relative effectiveness of insecticides applied by hydraulic and vapor sprays were carried out on grapes, apples, sour cherries, and peaches. Checks by cooperating entomologists showed that the hydraulic spray was more effective than the vapor spray on the grape leafhopper.

In comparative tests, the steam-vapor method of applying sulfur fungicides gave as good or superior control of peach leaf curl, apple scab, and cherry leaf spot as was obtained with the power sprayer; the efficiency of bordeaux mixture was reduced when subjected to the heat developed within the steam sprayer and the effectiveness of sulfur and combinations of sulfur and lime was markedly increased when applied with the steam vapor sprayer.

About one-third the amount of water and fungicide was required for adequate coverage when using the steam sprayer as compared with the power sprayer, but considerably more time was required to apply sprays with the former.

Tests on soil sterilization carried on in cooperation with the Ohio Agricultural Experiment Station in connection with ginseng and celery plantings showed that buried pipes for injecting steam into the soil under an inverted pan was much better than simply releasing steam under the pan. In order to effect the most rapid sterilization of the soil it was found that it should be well spaded and pulverized, but packed tightly over the steam pipes so that holes would not be blown open to the surface. Beds thus prepared could be raised to temperatures around 200° F. in 35 to 40 minutes.

A grasshopper-poison-bait distributor was developed in cooperation with the Bureau of Entomology and Plant Quarantine, and construction plans were distributed. A check up of the results obtained during the spring with more than 1,000 distributors built according to these plans showed excellent performance.

In the studies of machinery and methods of applying chemicals for controlling such weed pests as bindweed, whitetop, Canadian and perennial sowthistle, and horsenettle, in Utah and Idaho, considerable time was devoted to surveying present practices and considering suggested means of control. Among the suggestions recently made is that electricity can be used as a weed killer. Results of preliminary studies with weeds indicated that when a small current from a 9,300-volt circuit was applied, plants were killed above ground but new shoots soon appeared. Lowering the voltage to 532 and increasing the amperage had little apparent effect on the weeds. When current was passed through water in which a large number of morning-glory root stalks had been immersed a high percentage of them were killed. A similar result might be expected when passing a current through soil wet from irrigation water or rain.

Manure frequently causes heavy infestation of fields with weeds. Tests were made which showed that seed-infested chicken manure treated with live steam for periods of 2, 4, and 6 minutes produced a 100-percent kill of the weeds in all cases.

FERTILIZER-DISTRIBUTING MACHINERY

Studies of fertilizer placement for various crops and in various parts of the country have been carried on in recent years in cooperation with the Bureau of Plant Industry, many of the State agricultural experi-

ment stations, the National Joint Committee on Fertilizer Application, and the National Fertilizer Association. The variety and extent of this work in the past year are indicated by the following list of crops fertilized and the States where tests were made: Barley in Michigan; beans in Georgia, Michigan, and New York; cabbage, cauliflower, and celery in New York; corn in North Carolina; cotton in Georgia, Mississippi, North Carolina, and South Carolina; pasture in Indiana, Michigan, and Ohio; peanuts in Georgia and Virginia; peas in Maryland, Michigan, and New York; sweetpotatoes in Delaware, Maryland, and Virginia; sugar beets in Michigan, Ohio, and Wyoming; soybeans in Mississippi; spinach in Virginia; tobacco in Georgia, Maryland, Pennsylvania, North Carolina, and South Carolina; and tomatoes in Maryland, New York, and Virginia. This work included development of special equipment for experimentally placing fertilizer in various positions with respect to the seed and seedling, and the engineering phases of application. The Bureau now has 20 machines especially equipped for fertilizer-placement experiments. These are adapted for use on most of the crops grown under usual conditions.

As a result of the large number of tests on various crops, the investigators have concluded that the placement of fertilizer in a band at the side of the row gives the best results. But the best distance to the side of the seed or seedling differs for various crops as indicated by the following examples: With sweetpotatoes, in Delaware, the application of standard fertilizer over a 2-year period gave best average results when placed in a band 5 inches to each side of the row. With sugar beets, in Michigan, best results were obtained from the fertilizer when it was placed directly under the seed or one-half inch to the side. In the case of sweetpotatoes, side placement of fertilizer at the time of setting the slips produced 119 bushels per acre more than did broadcasting the fertilizer 2 weeks before planting.

Examples are accumulating which show the importance of precise placement of fertilizer for a variety of crops. Tests with cannery peas in Michigan showed that placement of plant food 2 inches to one side of the row gave a yield of 2,285 pounds per acre, whereas, when it was placed in a furrow with the seed, as is done with commercial machines, the yield was only 1,096 pounds and the stand of plants was only 50 percent of what it was in the other case.

The work on fertilizer machines and placement is already exerting a very noticeable effect on fertilizer practices and on the design of machines on the market. New machines, and attachments for use on old-type machines, are being put out by many companies for use with a great number of crops. Large numbers of growers throughout the country have adopted the improved methods, and in certain areas striking improvements have been observed.

CROP-PRODUCTION MACHINERY

The work on crop-production machinery included investigations of machines used in the production of sugar beets, cotton, corn, and sweetpotatoes, also general tillage-machinery investigations.

In recent years much progress has been made in improving and adding to the mechanical equipment for sugar beet production, which promises to do away with much of the stoop labor characteristic of this crop. Circular 488, entitled "Developments in Mechanical

Equipment and Methods in Sugar Beet Production," was published last year.

Studies were made of two different types of furrow openers for sugar-beet planters. They showed that planters equipped with disk openers gave a 40-percent larger stand than those equipped with shoe openers. The single-row, chain-feed, single-seed planter developed in 1937 was this year built on a multiple-row unit, and the plots planted with it were thinned about 15-percent faster than plots planted with a conventional planter. One result of using this new mechanism was a larger number of single seedlings which required less finger work in thinning.

A number of beet harvesters were studied, and an experimental variable-cut topper was devised to obtain better topping of the beets regardless of the variability in the height of the beet crowns above the ground. Two devices for cutting off the tops, the rotating disk knife and the straight stationary knife, have not been entirely satisfactory. An attempt has been made to design a cutter that would retain the good points of these two devices without the drawbacks. The result is an oscillating knife operated by a simple reaction drive which gives the knife 80 strokes a second with negligible power consumption.

In the studies of corn-production machinery carried on in cooperation with Iowa State College at Ames, various results have been obtained of interest to Midwest corn growers. Field studies showed little difference in yield between drilled corn and standard check row, but when corn was planted in 21-inch checks there was considerable increase in yield over the standard or 42-inch checking, the same number of seeds being planted per acre in both cases.

Tests of mechanical corn pickers showed much less field loss with certain hybrid varieties than with others. A new experimental snapping mechanism for picking reduced losses of shelled corn to about one-sixth of the losses caused by the standard snapping rollers. Since there is a steady increase in the number of corn pickers in use the significance of such a saving becomes apparent.

In attempts to get around the difficulty frequently experienced in controlling weeds in drill-planted corn, particularly in the early stages of growth during adverse weather conditions, efforts have been made to improve cultivation technique, and promising experimental attachments have been devised for the purpose. The development of a successful means of cultivating drill-planted corn would no doubt result in rapid abandonment of the more irksome check-row method of planting. This type of planting is particularly advantageous in contour farming, where the land is subject to erosion, and may result in the elimination of an important objection to terracing in the Corn Belt.

The need for developing methods and equipment for harvesting and handling sweetpotatoes so that the farmer can preserve his waste and surplus for stock feed has received attention in some exploratory studies. In this connection investigators are giving attention to such factors as seedbed preparation, planting, harvesting, and handling of the vines for silage. The work so far done in studying different ways of preparing and planting slips indicates that a considerable reduction in cost for these operations is possible.

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The rapid rise in popularity of green silage crops other than corn has led to studies of various phases of the problem including time, labor, power, machinery, and machinery investments for harvesting and ensiling these crops. The work was started in the spring by the Bureau in cooperation with the New Jersey Agricultural Experiment Station. Two silos were filled with cut grass, molasses preservative being used in one instance and acid preservative in the other. The grass was cut with a tractor-mower having a swath attachment, loaded by a hay loader into a truck, and hauled to the silo filler which chopped the grass and applied the preservative.

Indications are that the yields of silage grasses may fluctuate to a marked degree, which emphasizes the necessity of planning the work so as to keep the silo filler busy. This was done in one instance by the use of a windrow attachment, a field loader, and three trucks. Amounts up to 41 tons of silage per day were put up from a field yielding 10 tons per acre. Loading from the tractor swath and using two trucks on a field yielding 6 tons per acre, 25 tons were ensiled in a day. In the first case the silo-filling crew was busy 66 percent of the time and in the second case was busy only 42 percent of the time.

Observations showed that an experimental field harvester and chopper patterned after the grain combine has promise of usefulness in speeding up the job of ensiling grasses. When the grass was brought to the silo filler already properly chopped it took 25 percent less time to put it away in the silo than when it had to be chopped as well as elevated by the conventional silo filler.

An experimental conveyor-elevator built by the Bureau for putting this type of material into the silo was operated with a 3-horsepower electric motor, the only size available at the time. It seems probable that considerable savings in power and labor may be made in this phase of the work, the indications being that a 1-horsepower motor might be adequate for the purpose.

TILLAGE MACHINERY

Ever since the establishment of the Tillage Machinery Laboratory at Auburn, Ala., in 1935, studies have been made of the influence of various factors in design and equipment on tillage machines, on power requirements, and on the resulting condition of the seedbed and the yield and quality of crops. Nine distinct types of soil from the major crop-producing areas of the country have been assembled at the laboratory and placed in plots 250 by 20 by 2 feet in size. Fundamental studies are being carried on to determine for each soil type the draft, scouring qualities, abrasive action on soil-rubbing surfaces such as moldboards, and of soil packing by steel- and rubber-tired tractor wheels.

Tests of various plow shapes seemed to show that a moldboard conforming to the shape of a cylinder, fitted with a bevel-pointed share, offers less draft, scours better, and wears off less than a plow having a moldboard of conventional shape and a long-pointed share. Results obtained thus far tend to show that tractors equipped with rubber tires pack the soil more than do those having steel wheels with spade lugs.

By the use of the special equipment at Auburn, the investigators have shown that by reducing the angle between the moldboard and

the line of travel within certain practicable limits the draft of stubble-type plows can be lowered without noticeably affecting the quality of the plowing, although the capacity decreases slightly. Tests with conventional general-purpose moldboards and shares, with the angle between the moldboard and the direction of travel varying from 2½° greater than normal to 7½° less, showed that increasing or decreasing the angle 2½° did not affect the draft or quality of work appreciably but that if the angle were reduced more than 2½° the draft was increased and the plow did inferior work.

Observations on the performance of disk plows have brought out the importance of such factors as speed of the plow, the angle between the disk and the line of travel, the use of scrapers to take off adhering soil, the resistance of the disk bearing to rotation, and the soil condition. Indications are that as the colloid content of the soil increases (that is, as soil becomes more clayey) the draft, the vertical reaction upon the disk, and the side reaction increase.

A review of experiments during the past several years on seedbed preparation on a certain soil type in the Cotton Belt supports a former conclusion that a coarse, cloddy seedbed prepared 60 days before planting with a few simple operations, is superior to a finely pulverized seedbed produced by a large number of operations.

The variable-depth cotton planter, designed a number of years ago in the Bureau, continues to give good results. In most of the recent seasons this planter produced a stand of cotton in one planting as compared to replanting from one to four times when the ordinary method of planting at constant depth was used.

After 3 years of work with various methods of turning under leguminous cover crops to increase the yield of cotton it appears that the one-way disk harrow, with disks spaced 10 to 12 inches, and a wide-base plow (18-inch) are the most effective tools for this purpose.

RESEARCH IN MECHANICAL PROCESSING OF FARM PRODUCTS

Research work on the engineering phases of processing farm products is limited at present to problems of cotton picking, handling, ginning, and packaging, and of flax pulling, retting, and scutching. A peculiarity common to both of these crops is that the preliminary processing is carried on in the immediate neighborhood where they are grown. Cotton as a rule remains the property of the grower until after it has been ginned and baled. These studies in preliminary processing are of direct interest to the producers.

COTTON GINNING

The principal objectives of the cotton ginning investigations are to determine the effects of different methods of conditioning, cleaning, extracting, and ginning, and their interrelationship and correlation with the elements of quality of lint and ginned cottonseed, in order to improve quality of ginned cotton with resulting increased returns to cotton planters.

Studies were conducted to compare the handling of seed cotton through a separator and a Rembert-type fan. The saving in power and reduction in ginning cost were significantly in favor of the Rem-

bert unloading system. This is due to the fact that all air handled through the Rembert-type fan is doing useful work, whereas in the separator set-up much loss due to leakage is encountered. The improved cone-shaped Rembert-design unloading fan developed by this laboratory has an efficiency of approximately 56 percent as compared to 35 percent for flat-disk-type Rembert fans. Also, the cracking of seed which was noted with flat disks when a velocity of 4,000 feet per minute or greater was used was not noticeable in the new laboratory-designed fan. A large percentage of the cotton passing through the new-design fan never strikes the screened cone, and this fan is especially adapted to the latest double-fan, wye-system, tower-type drier set-ups.

A survey of mechanical equipment in commercial gins has revealed that a considerable saving in power can be made by modernizing present gins. The power being used to unload cotton for a four-stand gin ranged from 13 to 31 horsepower and the separator losses in volume of air ranged from 25 to 50 percent. Some of the air-blast gins were using nozzle pressure ranging from 11 to 18 inches on the water gage, which caused the air-blast fan to use from 9 to 36 horsepower. The data from the 32 ginneries surveyed showed that almost 50 percent of the power used in the entire plant was required to operate the fans.

Walrus hide has been principally used on roller gins, but recent tests at the laboratories have shown satisfactory results with such substitutes as rubber and canvas pump packing. In fact these substitutes for the walrus hide turned out samples of cotton slightly better in grade and staple than that ginned on the walrus-hide rollers.

Comparative ginning tests made with the roller and saw gins using various types of rollers and saws of different design on sea-island cotton grown in Georgia, Alabama, and Mississippi, confirm the belief that sea-island cotton or cottons longer than 1½ inches in staple length ginned by a roller gin are superior in quality and that the fiber is longer than when the same cotton is ginned on saw gins. When ginned on a saw gin the long cottons are very neppy while the roller-gin sample of the same cotton is free of neps.

Tests on new and worn gin saws with teeth of different shapes were continued and showed that roached-tooth saws normally give less lint turn-out than new straight-tooth saws. But when wear and filing reduce the diameter the roach tooth becomes straighter and the loss in cotton turn-out is not so noticeable as when straight-tooth saws are reduced in size by wear and sharpening.

Roll-box studies were started on a commercial 70-saw gin stand having a large, circular roll box. This gin was reduced to a 40-saw stand. The roll box was reduced in size, and tests were made of small circular, horizontal oval, and vertical oval boxes. The data from one season's tests indicates that by reducing the size and altering the shape of the roll box to form a small circular or vertical oval design, the ginning capacity is increased by 10 and 14 percent, respectively, with no loss in lint quality or turn-out. The horizontal oval box showed no significant advantages over the large circular roll box.

The laboratories experimented on cleaning seed cotton harvested with the mechanical cotton picker. Cotton thus harvested from 4

fields and cleaned with a 12-cylinder overhead cleaner and extractor in addition to the use of an extractor feeder averaged Low Middling in grade, a grade lower than the corresponding hand-picked cotton handled only through an extractor-feeder. Tests in cooperation with the Delta Experiment Station brought out that the differences in grade between hand-picked and machine-picked cotton are greater in some varieties than in others.

Tests were made in an effort to devise cheaper means of drying cotton that would be feasible for the smaller gin. A large-size house-heating furnace equipped with a fan having a capacity of 200,000 British thermal units per hour provided a drying temperature of 140° F. at the inlet of the drying chamber with 3,500 cubic feet of air per minute, which provided ample suction using the split-suction unloading system to accommodate not more than two gin stands. This process appears suitable for small ginning establishments, especially those handling short-staple cotton.

Some further study was given to the methods of utilizing exhaust heat and cooling water heat from Diesel engines for drying, and some improvements have been devised in the heat exchanger where experience indicated that greater strength was necessary.

Ten different designs of cleaning screens in a six-cylinder cross-drum flow cleaner were tested on both hand and mechanically picked cottons, and the results indicate that the standard hardware-cloth screen of ½-inch mesh was as effective in screening out trash as any of the other more expensive types. Some of the larger mesh screens were found to be unsatisfactory because they allowed small or single locks of cotton to pass through with the trash which in turn caused losses in turn-out without any material improvement in grade.

HIGH-DENSITY PACKING OF COTTON AT GINS

Last January authorization was given the Bureau to carry on studies of high-density packing of cotton, funds being provided from the Bankhead-Jones special research fund. The principal objectives are to ascertain the engineering and mechanical feasibility of packaging cotton in high-density bales at gins; the comparative costs and advantages of high-density gin compression as compared with the present procedures of gin packing and recompressing; the effect of high-density gin compression on the spinning value of cotton; and the requirements for a high-density gin bale satisfactory for conserving the quality of cotton and for transportation, storage, and handling.

The experimental equipment now comprises a revamped 3-stand ginnery, a 12-roll Clayton round-bale press, a 400-pound high-density Brazilian gin press, a special pilot press to be used as laboratory apparatus, and a 500-bale flat press, all complete with conditioning and extracting equipment.

The round-bale press provides cylindrical packages of cotton weighing 250 pounds each, with a nominal density of 33 pounds per cubic foot. This bale requires no steel ties or bands and permits samples to be withdrawn by an augur before the heads are sewed on, so the bale does not need to be cut. The 400-pound Brazilian press normally turns out a bale 20 inches wide by 40 inches long by 26 inches high with nominal density of 32 pounds per cubic foot.

The special pilot press permits packaging of bales containing 1 cubic foot of cotton and may have a density of 11, 22, 33, or 44 pounds of cotton per cubic foot. These small specimens and spinning-test bales may be covered with any one of various types of commercial bagging.

The laboratory has also obtained a wide variety of instruments for making records during tests. Among them are electrical instruments for measuring power; gas and electric meters; temperature recorders; recording psychrometric instruments; and various pressure gages for air, steam, gas, and hydraulic lines. The ginning plant set-up for packaging studies contains a 3–80 gin outfit and various pieces of modern auxiliary equipment.

This experimental project is carried on cooperatively with the Bureau of Agricultural Economics which undertook to compile a survey of as many commercial cotton compresses as possible by the end of the fiscal year. At the same time extensive studies were made at several cotton compresses in New Orleans, La., Greenville, Miss., and Memphis, Tenn. Among other things, studies were conducted to explain the causes of bale-press cuts to which spinning mills have frequently objected. Informal reports from the spinning laboratories indicate that fiber damage resulting from these cuts is not significant but the amount of waste may be increased and the damage to the covering causes more rapid deterioration of the lint. The investigators concluded that since these cuts have been encountered for many years in the standard-density compression of cotton their presence is more objectionable from the standpoint of appearance than from that of actual fiber damage.

FIBER-FLAX PROCESSING INVESTIGATIONS

Under the authority of the Agricultural Appropriation Act for the fiscal year 1939, investigations directed toward the improvement of fiber-flax production in the United States were begun in July 1938, with headquarters at Corvallis, Oreg.

The first step in these investigations was a study of the work under way at the three cooperative retting and scutching plants located at Canby, Mount Angel, and Springfield, Oreg., to obtain records of the time and labor required and their costs for the different operations in retting and scutching flax. A study was also made of the equipment farmers use for pulling flax. From this work it became apparent that there is a possibility of improving equipment for pulling flax and that there are apparently opportunities for adjustments in operations that might reduce costs in the retting and scutching plants.

The investigators obtained a flax puller of the type in common use in Oregon and rebuilt it in an effort to improve its reliability in operation. Preliminary tests in June indicated that some progress had been made, but that further changes are desirable. A flax puller of a type widely used in Europe was imported from Belgium and preliminary tests indicate it will operate satisfactorily under Oregon conditions.

One of the problems of the flax industry everywhere has been the separation of the shives from the tow. A tow shaker was designed, built, and placed in use at one of the cooperatives. It separates the tow from the shives so much more efficiently than the equipment formerly used at this plant that the weight of the partially cleaned tow

was reduced 50 percent. This represents a saving of 50 percent in handling and transportation cost to a tow-scutching machine located in a nearby town.

The deseeders in use at the cooperatives were of limited capacity and their operation required considerable labor. A design for a deseeder of another type was prepared and the machine constructed. It operated satisfactorily. The Bureau bought a deseeder of the type in common use in Belgium, which will be available for test during the 1940 fiscal year.

One problem that has been giving considerable trouble to the flax cooperatives is that of disposal of the retting water. Facts already obtained indicate it may be possible to work out a method of disposing of the waste water by furrow irrigation without creating a nuisance. As time permitted, the investigators studied the operations of the retting and scutching plants. The problem of reducing the cost here is more complicated than in the operations previously mentioned, but they believe that eventually improvements can be made that will materially reduce the cost of producing fiber-flax at the plants.

A small building which can be used as a laboratory for testing machinery and methods and for storing equipment was constructed on the farm of the Oregon Agricultural Experiment Station.

FARM-OPERATING-EFFICIENCY INVESTIGATIONS

For a number of years the Bureau has carried on continuous investigations on farms in a number of States with the object of improving engineering factors in farm operation and coordinating them with various other factors. The object has not been to determine the exact benefits of development of individual projects such as, for example, drainage improvements, land clearing, buildings, machinery equipment, rearrangement and enlargement of fields, etc., but to determine the good results that can be obtained through proper planning and operation of the whole farm.

Since 1929, 120 typical farms have been studied throughout the humid region from northern Minnesota to southern Georgia, to determine their engineering problems in development and organization. The studies have shown that every farm, regardless of its size, type, and location, is capable of improvement through better use of available resources and the improvement of the organization.

On a large number of farms, efficient farming is prevented by the lack of balance in land condition, power, machinery, buildings, labor, crops, and livestock. Patchy fields of irregular size and shape with wet spots, gullies, stumps, stone, misplaced ditches, and overgrown fence rows prevent low-cost crop production. Improper and inadequate power prevents timely field work and machinery of unsuitable size, design, or condition prevents thorough and timely tillage. Misplaced roads, fences, and lanes increase the overhead costs of labor, power, and machinery. Inadequate buildings prevent the proper care of livestock, crops, and equipment. The initial studies of farms provide for the correction of these maladjustments through the development of balanced operating plans.

Records obtained from 90 farms in Minnesota, Michigan, Ohio, and Virginia indicate that a large proportion of them are being im-

proved according to the operating plans. The 25 farms studied in 1 State showed the following range of problems and progress:

About three-fourths of the farms lacked adequate drainage; 18 had land-clearing problems to solve before fields could be properly shaped; 16 had suitable land and water for the development of irrigation, while only 4 were equipped for irrigation. Soil erosion was active on 24, but about one-half of the area subject to erosion is being protected with terraces, strip cropping, and soil-saving dams. About 50 percent of the recommended field improvement has been completed. This resulted in increasing the average size of fields from 4.4 acres per field to 11.6 acres. Power changes represent a decrease of 5 percent in the number of work horses and an increase of 22 percent in the number of tractors. Construction on 25 farms has included 7 barns, 12 silos, 5 fruit- and vegetable-storage houses, 9 tenant houses, and the remodeling of 8 farm homes. About two-thirds of the farms and one-third of the tenant houses have electric service.

RURAL ELECTRIFICATION RESEARCH

The Seventy-fifth Congress appropriated $30,000 to be used for rural electrification research in the Bureau during the fiscal year 1939. A project was prepared with the following objectives in mind: (1) Survey and collate information on rural electrification research in the State agricultural experiment stations; (2) make case studies of farms in various parts of the country, and by careful engineering analysis discover how the use of electrical equipment may be fitted economically into the farm program; (3) discover new uses, design new equipment, or redesign existing equipment to meet the needs of farm operations requiring both stationary and tractive power, keeping in mind always the low-income farm and the fact that applications of electricity on those farms must be at least self-sustaining or income producing; (4) study fundamental problems, such as those relating to the influence of electricity, light, heat, magnetism, and other associated phenomena upon plants and animals.

Seven men experienced in rural electrification were borrowed for 1 month each from colleges and sent to visit State experiment stations in 37 States where research has been or is now being conducted in the applications of electricity in agriculture. The survey was concerned primarily with applications in the dairy and poultry industries. Many studies have been conducted in these enterprises and results published by the several stations. Of the studies or observations made most were concerned with energy requirements, immediate costs, and immediate results, and but few with the basic principles involved.

Information obtained in the survey revealed considerable disagreement among research workers. Some of these differences are traceable to different climatic and economic conditions, others to types of agriculture followed, while yet other variations are no doubt due to methods of and care with which experiments were conducted. An example of the first is that of separating cream and churning. In Wisconsin most of the milk is sold in bulk to dairy-manufacturing concerns, and very little butter is made on the farm. On the other hand Penn-

sylvania farmers market about 1 million pounds of butter annually.

Cooperative associations find that a uniformity of product works to their advantage, consequently uniformity of feed is essential. (This is especially true of poultry.) For this reason poultry cooperatives like to have grinding and mixing done by a limited number of mills. New England farms do not produce all of the ingredients of poultry feed and since the farmer must buy them, he usually has them mixed at the mill where the mixing is included in the cost.

Cooperative agreements have been made between the Bureau and the State agricultural experiment stations of Virginia, Indiana, and Nebraska to carry on research in rural electrification. Under these agreements, case and equipment studies are now in progress. These studies include the use of electricity in irrigation of home gardens; the needs of farm refrigeration, and the control of the European corn borer by means of electric-light traps.

Work at these stations has not been in progress long enough to yield definite results, but records of work carried on show that they are being obtained. A preliminary report from Indiana on electric pig brooders reads as follows:

During the winter of 1938 five sows farrowed 52 live pigs which were all raised to weaning time. At the same time two sows, which farrowed 24 pigs in houses without electric heaters, crushed four of them by lying on them. This loss is attributed to the pigs lying close to the sows to keep warm. An underheat type of heater designed and developed in the work at this institution will be manufactured by an Indiana firm and available for use in the spring of 1940.

Another report from the same station on the control of the European corn borer is also of interest:

Ten electric traps destroyed 11,167 corn-borer moths in a 10-acre field of corn in Northeastern Indiana from June 19 until August 26, 1939. These results furnish definite indication of the possibility of reducing infestation, perhaps controlling, this pest, since more than 60 percent females were caught. Examination of the females captured disclosed a large percentage of them to be gravid. The following table indicates the reduction in the area lighted by the traps when compared with similar areas.

Populations and infestations in check fields as compared to lighted block

Check area	Percent of plants infested	Number of borers per 100 plants	Percent reduction in lighted area
Lighted block of 10 acres	52.5	78.75	
Unlighted block of 7 acres—same field	80.0	234.40	71.30
Unlighted field ¼ mile away planted on same date	89.0	320.40	77.91
Unlighted field ¾ mile removed	79.0	308.60	74.12
Unlighted field 1 mile removed	88.0	316.00	75.08

The capture of larger numbers of moths by some traps than others is difficult of explanation, although wind direction and elevation in the field seem to be possible reasons. The economy of using such equipment for field corn is as yet debatable, although its use for protecting sweet corn in heavily infested areas may be advisable from present knowledge. The 1939 results have been so favorable that more extensive work in succeeding years should be made. This is especially advisable since reports from State entomologists indicate that the corn borer was found in Northern Illinois and Southern Wisconsin during 1939.

REGIONAL RESEARCH LABORATORIES

During the first year following the enactment of legislation authorizing the establishment and maintenance of four regional research laboratories by the Department of Agriculture, there were important accomplishments toward that end. The four major producing areas and the commodities to be given initial research attention in specific areas have been designated as follows:

Northern area—Illinois, Indiana, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Michigan. Commodities—corn, wheat, and crop residues.

Southern area—Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, South Carolina, and Texas. Commodities—cotton, sweetpotatoes, and peanuts.

Eastern area—Connecticut, Delaware, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Tennessee, Vermont, Virginia, and West Virginia. Commodities—tobacco, apples, potatoes, milk products, and vegetables.

Western area—Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. Commodities—fruits (other than apples), vegetables, potatoes, wheat, and alfalfa.

A survey was made to determine the location of the regional laboratories and the scope of the investigations to be undertaken, and to coordinate the investigations with current research work. The report of this survey was published as Senate Document No. 65, Seventy-sixth Congress, first session. On the basis of the survey, locations for the laboratories were selected as follows: Northern laboratory, Peoria, Ill.; southern laboratory, New Orleans, La.; eastern laboratory, Philadelphia area, Pa.; and western laboratory, San Francisco Bay area, Calif. The definite locations finally selected for the eastern and western laboratories were Wyndmoor, Pa., and Albany, Calif., respectively.

Plans and specifications for the four regional laboratory buildings were prepared and contracts were awarded for their construction. Directors were appointed for the four laboratories, and a few of the other key positions were filled. Regional headquarters were established in each area near the site of the proposed laboratory. Preliminary work was done on planning and coordination of research programs.

Throughout this first year the public has manifested marked interest in the regional laboratories. The many departmental and State groups and private organizations consulted have given generously of their time and attention. Many letters containing suggestions and comments have been received, and a large number of requests from local, State, and National organizations for information about the projected work have been answered by addresses and papers presented by members of the regional research laboratories staff.

INFORMATION AND PUBLICATIONS

The Bureau published 3 Technical Bulletins, 3 Circulars, 3 Miscellaneous Publications, 3 Farmers' Bulletins, 3 articles in the Journal of Agricultural Research, 2 Leaflets, 4 Yearbook articles, 1 article in The Agricultural Situation, 1 annual report, 1 Senate Document, 45 mimeographed publications, and 241 articles in out-

side journals and proceedings, 8 of which were also mimeographed. The Bureau also furnished information on various phases of its research through the press and radio services of the Department.

Thirteen patents were issued to scientists of the Bureau during the year.

The following lists show the publications and patents of the research divisions of this Bureau:

LIST OF PUBLICATIONS

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Preparation of rhamnose from naringin. By G. N. Pulley and H. W. von Loesecke. Amer. Chem. Soc. Jour. 61: 175–176. 1939.

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Observations of the effect of ethylene on the softening of Yakima grown bartlett pears. By William Rabak. West. Canner and Packer 31 (4): 26–28. 1939.

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The acid-base balance of cereals and some related food materials. By Jehiel Davidson and J. A. LeClerc. Food Res. 3 (4): 393–402. 1938.

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Report of the Chief

of the

Bureau of Agricultural Economics

1939

REPORT OF THE CHIEF OF THE BUREAU OF AGRICULTURAL ECONOMICS, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF AGRICULTURAL ECONOMICS,
Washington, D. C., October 15, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith the report of the Bureau of Agricultural Economics for the fiscal year ended June 30, 1939.

Sincerely yours,

HOWARD R. TOLLEY, *Chief.*

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REORGANIZATION

Fiscal 1939 was reorganization year for the Bureau of Agricultural Economics: A year that witnessed transformation of the Bureau from an agency dealing in economic analyses and performing a multitude of statistical, service, and regulatory duties into an agency functioning with a Department-wide scope both as a clearinghouse for agricultural planning in the Nation and as an economic-research organization.

Reorganization of the Bureau was directed by the Secretary of Agriculture on October 6, 1938, as a part of the departmental reorganization of that date, and became fully effective on July 1, 1939,

with the operation of the 1940 Department of Agriculture Appropriation Act. Hence, the fiscal year 1939 was devoted in large part to reconstitution of the Bureau to meet the responsibilities placed upon it by the Secretary. Many activities and functions of the previous Bureau remain; others were transferred to the present Agricultural Marketing Service; still others became a part of the present Bureau through transfer from other agencies. All have been recast or given new direction to conform to the Secretary's intent to establish a general departmental planning agency that also would bring to a focus the results of economic and social research and the influence of farmer judgments as expressed through community, county, and State planning committees.

The Secretary said in his memorandum October 6:

> It is imperative that we establish over-all planning work for the whole Department in order to provide for proper functioning of the many new activities authorized in recent years by the Congress. * * * This has become all the more necessary since the Department last July entered into a significant and far-reaching agreement with the Land-Grant College Association. Under this agreement, the colleges and the Department are establishing democratic procedures that will give farm people an effective voice in forming, correlating, and localizing public agricultural programs. Farm people and official agencies in the States are now forming community, county, and State groups to carry on land-use planning and program building. In the expanded Bureau of Agricultural Economics, the Department is now establishing its part of the machinery needed to integrate State and local planning with general planning and program-forming activities within the Department.

The story of the Bureau's year is, in the main, the story of its endeavor to comply with those instructions. As it is now organized, all the work of the Bureau heads up in the Chief, who is responsible to the Secretary for performance of the duties outlined here. To further the performance of these duties, six major groups of activities have been designated, in the charge of key men who are responsible for the development, coordination, and integration of Bureau work. These men are assigned one to each of these fields: (1) General planning; (2) rural welfare; (3) conservation and land use adjustment; (4) market planning; (5) the agricultural outlook; and (6) program relations.

The men in charge of these general fields of activity function in cooperation with the Bureau's divisions and other agencies of the Department. They are also members of inter-Bureau coordinating committee, to which all plans—whether the product of county planning committees, technical suggestion, or administrative proposal—are being sent and from which are to come the recommendations the Chief is to make to the Secretary through the Agricultural Program Board.

The Chief of the Bureau is the chairman of this coordinating committee. Its membership includes a representative from each of the departmental agencies that have an important interest in planning for action, so that views of these agencies may influence the Bureau's recommendations throughout the process of formulation.

In addition, the heads of all the Bureau's divisions are members of the coordinating committee. Such a committee would be unwieldy if it attempted to act at all times as a unit. It operates, therefore, on a very flexible basis, with numerous subcommittees set up to deal with specific problems. The services of a subcommittee are termi-

nated with the solution of its problem. Members of each subcommittee will include representatives of every agency interested in such a problem.

The findings of each subcommittee will go directly to the Chief of the Bureau and, after his approval, from the Chief to the Secretary through the Agricultural Program Board of the Department, composed of the heads of the Department agencies, to be put into effect if the Secretary concurs in the finished product of this process.

Attached to the office of the Chief are seven coordinate lines of work designed and staffed to serve the Bureau generally from central points in the fields of management, operation, and administrative work in cooperation with the administrative, clerical, fiscal, and research staffs of the divisions in Washington and the field service of the Bureau. Each staff functions as a clearinghouse for the respective type of work indicated by its title, namely: budget and estimates; employment records; fiscal (audits, pay rolls, and accounts); library; mails, files, and visa; organization and classification; and procurement.

The divisional organization of the Bureau is not compartmentalized into separate research and planning units; in nearly every instance, the two functions are merged in the activity of each division. The divisions of the Bureau are: Agricultural Finance, Economic Information, Farm Management and Costs, Farm Population and Rural Welfare, Land Economics, Statistical and Historical Research, State and Local Planning, Program Surveys, Marketing and Transportation Research, Program Study and Discussion, Program Development and Coordination, Marketing Programs and Coordination. The nature of the specific duties performed by each will become apparent in the course of this report. It should be emphasized, however, that rigid jurisdictional lines have no place in the Bureau as now constituted.

PLANNING FOR NATION AND NEIGHBORHOOD

Of the greatest significance in the present Bureau are its methods of bringing farmer opinion to bear upon the formulation of agricultural programs. Its objective in setting up these channels of influence has been to provide for the fusion of farmer, technical, and administrative views throughout the process of program and policy creation, beginning with the local community.

STATE AND LOCAL PLANNING

In March the Bureau undertook to promote, in cooperation with State agricultural colleges, the building of comprehensive land use plans, policies, and programs through the joint participation of farmers, technicians, and administrators. Such plans and policies are designed to secure the coordination and correlation of public and group action at community, county, State, and national bases, and for the translation of appropriate conclusions on desirable agricultural adjustments into specific plans and programs for local, State, and departmental action agencies.

The Bureau maintains a representative in each State who works closely with action agencies in the coordination of program objec-

tives and operations, and with State agricultural colleges responsible for the educational work, and with research organizations in the investigational and technical aspects of planning and program development. Seven regional representatives of the Bureau maintain advisory liaison relationships with State representatives and action agencies in the field. A small administrative and technical staff in Washington formulates general procedures for the conduct of planning work and reviews and analyzes the planning done in the States before its adoption as a basis for program revision and coordination, or for the formulation of new programs.

Planning activities in the field are conducted through State land-use planning committees consisting of representatives of State and departmental agencies working in the field of agriculture and farmers representing important type-of-farming areas. The State extension director is chairman, and the State representative of the Bureau is secretary of the committee. These representatives and the State extension and experiment station directors or their representatives constitute the joint land-grant college-Bureau of Agricultural Economics committee which acts as an informal working subcommittee of the State land use planning committee. In the counties planning is conducted by county committees on which State and departmental agencies are represented, but on which farmers predominate. Subcommittees organized on a community basis do much of the detailed work upon which county plans are based.

ORGANIZING FOR PLANNING

Much of the Bureau's State and local planning work to date has been organizational. Working relationships have been clarified and described in memoranda of understanding which have been negotiated with 45 of the land-grant colleges. Project agreements covering the details of the first year's work are being entered into with these 45 institutions.

Three major lines of planning work in the counties are known as preparatory work, intensive planning work, and unified county programs. Preparatory work, designed to acquaint county agents and local planning committees with the scope and objectives of land use planning and to prepare them to engage in this work, has been inaugurated in about 830 counties. Intensive planning work, involving area mapping and classification and the formulation of immediate and long-time land use plans and adjustment goals for the county, was undertaken in 447 counties representing the major type-of-farming areas in each State. Forty-four counties in 39 States have been selected, and 2 other States have tentatively selected counties for the development of unified county programs. The remaining States are in the process of selecting unified-program counties. Unified county program development involves the translating of land use plans into action. It involves coordination and revision of existing departmental, State, and local programs, and the formulation of new programs to best achieve recommended adjustments in land use and rural institutions.

The participation and interest of farmers and State officials in these phases of the work have been enthusiastic, and reports received from many sections of the country indicate that a wide variety of

benefits are being and will be achieved for agriculture through the operation of the county planning program.

During the year 1939–40, the preparatory, intensive, and unified phases of county planning will be continued and strengthened. The guidance and information supplied to county committees will be increased, and emphasis will be placed upon obtaining wider and truly democratic farmer participation. Area mapping and classification are expected to be completed in 447 counties and initiated in about the same number of new counties. At least 1 county in each State and as many more as possible, are to be aided in developing unified programs for administration in 1941.

NATIONAL PROBLEMS AND POLICIES

The Bureau conceives that a part of its responsibility, in dealing with large national questions, is to call attention to major problems in which agriculture has an important stake and to possible lines of attack on those problems. As a means to that end, it has inaugurated a series of special reports summarizing pertinent available knowledge concerning specific national problems and outlining the available approaches to solutions. The first of these was the report, Barriers to Internal Trade in Agricultural Products, already issued. Three others, one dealing with technological and related developments, one with principal aspects of farm labor, and one dissecting and appraising subsistence homestead projects administered by the Farm Security Administration, are now in preparation. This last has been undertaken by the Bureau at the request of the Farm Security Administration.

INTERNAL TRADE BARRIERS

The special report dealing with the alarming growth of interstate and interregional barriers to the free movement and sale of farm products within the United States was issued in March. The report was based on an extensive survey of Federal, State, and municipal legislation and regulations. This survey was made in close cooperation with State officials, including State commissioners of agriculture, State marketing officials, and the Council of State Governments.

This study of internal trade barriers has attracted a great deal of interest. The Council of State Governments and several other groups are now actively working on a program to eliminate unnecessary trade barriers and to provide for the free movement and unhampered sale of agricultural products in all markets. This does not mean, of course, the abandonment of all regulations dealing with the marketing of farm products. There is and will be a continuing need for regulations to protect the consumer against injurious foods, to protect the farmer against the spread of insect pests and diseases, and for similar purposes. But the study has revealed that many of the existing laws and regulations are discriminatory, that in effect they are similar to import duties for the protection of small groups of producers at the expense of other producers and of consumers.

Research is being continued on this problem, in cooperation with a number of other agencies, including all Bureaus of the Department of Agriculture, several other Federal departments, and several organizations of State officials. Since the issuance of the Bureau's report on

internal trade barriers, the State legislatures have killed about 60 bills which would have raised additional barriers to interstate trade in farm products. A few important barriers were eliminated. Efforts are being made to develop a constructive program in which the Federal and State governments can cooperate, for the lowering of the worst of the remaining trade barriers in the next 2 years.

AGRICULTURAL TECHNOLOGY

Last April the Bureau initiated a study of the consequences of current technological and related developments with a view to forecasting resultant changes in agriculture in the next 10 years. The flow of technological improvements—particularly in the fields of chemistry, biology, farm equipment, transportation, and marketing—brings about changes in agricultural production, farm organization, and farm practices that may profoundly affect rural welfare. Although some persons benefit from the resulting changes, the consequences, as in the case of displaced tenants or disadvantaged small farmers, may be serious distress and social maladjustment. The trend of developments may even be contrary to objectives of agricultural programs. A knowledge of these changes is important in outlining agricultural programs and in planning (1) to avoid serious maladjustments or to cushion the shock of too rapid changes, and (2) to take advantage of new opportunities offered by new techniques.

The study of technological developments is intended to provide a basis for (1) directing the effects of new developments into socially desirable channels, (2) guiding agricultural programs so as to minimize the effects of maladjustments, and (3) providing information regarding the effects of technological trends on national policies. The phase of the technological study now under way attempts to summarize through committees composed of representatives of several bureaus of the Department, the progress that has been made in, and the potentialities of, the more important technological developments. The primary objective is to determine the incidence of benefits derived from these developments, to ascertain which groups in agriculture will be placed at a disadvantage as a result, and to suggest ameliorative programs if possible.

FARM LABOR

The research study being made by the Committee on Farm Labor is nearing completion. This report will contain data concerning the civil, political, social, and economic status of our farm laborers. The report will show the civil and political restrictions and the living and social conditions under which large numbers of farm workers labor; age, sex, numbers, and distribution; working conditions and employer treatment; and the presence or absence of social legislation in their behalf. The report will deal with the farm-labor market and how it is affected by industrial maladjustment and population pressure, and will tell the story of unpaid family labor, wage hands, seasonal workers, migratory labor, and children who work hard for little or no pay. The underlying conditions affecting farm-labor supply and demand will be discussed, together with the economic factors and the mental attitudes that hinder solution of these problems. The report will offer suggestions for improving farm laboring conditions.

PROGRAM STUDY AND DISCUSSION

Development of program study and discussion, previously an activity of the Agricultural Adjustment Administration, became a function of this Bureau with the reorganization of the Department.

Probably 2,000,000 farm men and women in the last 4 years have taken part in discussion groups organized by the land-grant colleges, with assistance in the way of knowledge of techniques and provision of study materials by the program study and discussion workers of the Department. Under the departmental reorganization, this work is given the Bureau as an aid to county agricultural planning development.

Program study and discussion work now is aimed at (1) organizing leadership-training schools in cooperation with the State agricultural colleges and the several administrative and educational agencies of the Department, with staffs of experts drawn from the State colleges, liberal-arts universities, research foundations, farm organizations, and governmental agencies; (2) cooperating with State agricultural colleges, farm organizations, and other agencies in promoting, organizing, and conducting discussion groups in communities; and (3) preparing and supplying discussion outlines and materials and otherwise assisting farm people, agricultural colleges, and other agencies in promoting discussion of current agricultural problems, in the effort to provide a better basis for understanding by agricultural leaders, farmers, State and Federal agencies, and others, of the broad social and economic implications of agricultural adjustment, rehabilitation, conservation, and related policies.

In cooperation with the State discussion leader, appointed by the extension services in most States, many training conferences have been held for local leaders of farmer discussion groups. These local leaders, in turn, meet several times each winter with groups of 15 to 20 people in various communities for informal discussions of rural problems.

To assist the leaders, the Bureau will prepare and distribute in readable, nontechnical language a series of publications containing both factual material and expressions of divergent points of view current in the country on the topics for discussion.

In its schools for agricultural workers, the Bureau emphasizes open, critical discussions and concentrated study of the question, "What is a desirable national agricultural program?" To date, some 55 of these schools have been held, in 35 States, with an aggregate attendance of about 10,000 persons. The schools usually remain in session for 4 days. Their purposes are to enable farm leaders and agricultural workers to obtain a better understanding of present agricultural programs and policies; to give them a chance to renew their perspectives on agriculture as a whole; to stimulate independent thinking on social and economic questions, and to help to prepare leaders for county agricultural-planning activity, and for local farmer discussion groups.

RELATING RESEARCH AND PLANNING

Prominent among the obligations of the Bureau in its present position in the Department is the obligation to create a living rela-

tionship between agricultural planning and economic and social research. The objective in the construction of the present Bureau has been to give responsibility both in planning and in research to virtually every one of its divisions. The necessity for making the results of research an inherent part of the planning process accounts in considerable degree, for the previously mentioned attempt to avoid hard-and-fast jurisdictional lines between these divisions.

COOPERATIVE RESEARCH IN PLANNING

The Bureau will give much attention to the formulation of cooperative research projects to help guide the development of agricultural planning, and to the setting up of observational studies to learn the effect that various action programs, and the unified programs, are having on the agricultural economy in local areas. It will sponsor several cooperative demonstrational studies to aid in improving the techniques and procedures of land-use planning.

The Washington staff will analyze and summarize reports, maps, and recommendations prepared by local committees, and will develop aids to the orientation and synthesis of county plans at the State and regional levels. These efforts will facilitate the incorporation of farmers' planning and thinking in the action programs of the Department. In the field, the Bureau will inaugurate systematic examination and appraisal of flood-control, water-facilities, land-acquisition, and other area plans developed by technical survey agencies, and will strive to integrate this work with farmer planning activities.

Fundamental to much of that work are the collections and services of the Bureau library, which also serves other economic units of the Department. Through its processed monthly publication, Agricultural Economics Literature, practically all significant material on agricultural economics published throughout the world is reviewed, briefed, or noted. This publication has a strictly limited but virtually world-wide distribution. Besides the library's continual reference work and circulation of books and periodicals to the technical and economic staff of the Bureau, it issues comprehensive bibliographies on subjects of research by the Bureau—notably land utilization, agricultural labor, income, rural psychology, price fixing, and transportation.

ADJUSTMENTS IN LAND USE

The Bureau's work in land economics is concerned with research and planning relating to adjustments in the use of land. Some adjustments involve direct changes in land use such as reforestation of abandoned cropland; others are in the nature of indirect changes such as a more effective public or group control over the use of range lands to eliminate overgrazing. Adjustments of a direct nature may be accomplished by public purchase of land and development for an alternative use, by flood control through the construction of dams and through erosion-control measures, and by the provision of water facilities on tracts of land, like wells, stock-water tanks, and water spreaders.

Adjustments of an indirect nature may be accomplished through changing certain practices and customs and modifying institutional forces affecting the relationships of farm people to the use of land, such

as land tenure, property taxation, and the structure of rural local government. Land use adjustment is thus a process requiring considerable time for changes to be visibly accomplished, and requiring also careful planning and research preliminary to action.

Many requests from State and local officials for technical assistance in land-use adjustment, especially those of an economic and institutional nature, indicate a widespread and increasing awareness of land problems. They also indicate a realization that local steps must be taken to complement and supplement the programs of Federal agencies, and to lessen huge outlays required for purely Federal activity. Active and articulate county planning committees now form the nucleus of such an approach to local land use problems. In response to requests from such sources, practical research attention has been given to land use classification, rural zoning, grazing-district legislation, revision in taxation procedure, landlord-tenant relationships, and rural government and finance. Many studies have been made in particular areas to analyze the place of land use adjustment measures under specific local conditions, and to determine how local planning and action programs can be fused with those developed from State, regional, and national standpoints. A wide range of adjustments, complementing and supplementing Federal measures, can be accomplished by modifications of State laws, local ordinances, and administrative practices, or by other measures of a State and local nature.

It is clear that the development of land-utilization policy depends upon and is stemming from the desires of farm people for land use adjustments and for factual knowledge of land use conditions, problems, and solutions in various areas. The contributions the Bureau is making toward policy formation are being brought into an integrated program, modified and adapted to current needs of communities and the Nation as a whole.

RESEARCH AND CONSERVATION PROGRAMS

The Bureau has continued its observational studies of the regional conservation programs in selected areas, and has assumed major responsibility for outlining and participating in studies of the effectiveness of experimental county programs and experimental phases of regional conservation programs. These studies have focused attention on the reasons for the lag in conservation accomplishments as compared with expectations. Recognition and analysis of these reasons serve as a foundation upon which more effective programs of conservation and adjustment can be built.

Five of the twenty-six studies in the field of agricultural conservation and adjustment concern special phases of regional problems. Special problems of this type on which reports recently have been completed include: (1) Production of food and feed crops in relation to farm needs in the South, (2) the 1938 restoration land program, (3) relation of the agricultural conservation program to low-income farmers in the Northeast, and (4) opportunities for profitable use of additional forage in the Corn Belt.

How best to use the land released from cotton production through programs of the Agricultural Adjustment Administration and the possible use of such land for production of farm food and feed crops

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formed the central question in the cooperative study of farm food and feed. Participants with the Bureau were the Agricultural Adjustment Administration and the extension services and experiment stations in the cooperating States. Further objectives were to ascertain how self-sufficient southern farm people are in various areas with respect to commodities now grown on their farms and, from a physical standpoint, how self-sufficient southern farmers could be.

The Bureau initiated a study of the restoration land phase of the agricultural conservation program in the spring and summer of 1938. This was carried out in cooperation with the Agricultural Adjustment Administration and the State colleges in the Great Plains States. Objectives were to determine (1) the effectiveness of the program in taking unproductive cropland of production; (2) the attitude of farmers toward retirement of land from cultivation; and (3) modifications needed to make the program more effective in the future. Several of the recommendations resulting from the study have been incorporated in the present restoration land program.

LAND CLASSIFICATION

Illustrative of the practical accomplishment of land classifications in planning for land use adjustments is the study in Pine County, Minn. In the eastern part of the county many acres of land were subject to forfeiture to the State for nonpayment of taxes. Attempts to farm land that is not adapted to agriculture, moreover, led to high relief costs and to inefficient expenditures of public funds. The recognition by local people that the use of land for purposes to which it was ill-adapted had given rise to serious problems affecting all groups and prompted a demand for securing general agreement as to specific areas in which various land uses should be encouraged and for agreement as to how adjustments might be accomplished.

In answer to this demand the Bureau provided the means for bringing together various groups affected. After joint discussion of the problems and potential land policies, local residents through committees classified the land as either suited to agriculture or unsuited to this use.

Out of this joint study came a new understanding of the problems and the methods of dealing with them. This led to concrete recommendations for future policies mutually acceptable to all groups. The local committees strongly urged that the county board sell tax-forfeited land only in the districts that are classed as agricultural and requested the State Legislature to grant the county legal authority to guide future settlement into such areas. The county board has officially taken cognizance of the recommendation as to the sales policy for tax-forfeited land, while the legislature passed the necessary enabling legislation to permit rural zoning.

A rather detailed methodology was devised for mapping and land use classification through the joint efforts of Department and college technicians and of farm people. Work outlines and plans for the land use classification phase of the flood-control and water-facilities programs were developed. Experimental research was made in several counties to bring about closer coordination of land use classification methodology with the technical requirements of planning programs. Technical studies were made of map structure and meth-

odology in measuring areas. Assistance was rendered in preparing proposals for land-utilization projects, in appraising these and other land-acquisition proposals, and in selecting sites for land-utilization projects.

Significant was the adoption in the Bureau's county agricultural planning program of the land use-classification scheme based on analysis of both physical and human factors relating to land use in specific areas. This approach not only considers land use problems and requirements of farm people, but it also includes formulation of specific programs attainable through coordinated efforts of State and Federal action agencies. Developed largely from experience in making land use classifications, the approach has already facilitated efforts to coordinate plans and activities in the agricultural program. Continued emphasis will therefore be placed on the development, improvement, and clarification of this approach.

FLOOD CONTROL AND LAND USE ADJUSTMENTS

To carry out the planning phase of land use adjustments, the Bureau cooperated closely in the programs of land acquisition, flood control, and the providing of water facilities. Field personnel selected sites for land-utilization purchase projects, and, in cooperation with the Soil Conservation Service, prepared preliminary project proposals. The Flood Control Section and the Water Utilization Section were assigned responsibility for the planning and research phases of the flood-control and water-facilities programs, respectively. In carrying forward planning phases of economic and institutional adjustments in land use, the Bureau fused its efforts with those of other Federal agencies, State colleges, State and local organizations concerned with land use adjustments, and local farm people. Following the reorganization of the Bureau, these activities were adjusted to meet the demands for technical guidance and assistance in developing the county-planning program.

In the planning phase of the flood-control program, preliminary examinations were completed on 76 watersheds, 42 of them during the year. Preliminary examinations are for the purpose of obtaining certain facts basic to determining whether technically sound and economically feasible programs for run-off and water-flow retardation and soil erosion prevention appear possible of accomplishment. These preliminary examinations led to the undertaking of detailed surveys on 18 watersheds.

In order that the flood-control program of the Department may develop along lines that are both economically and socially sound, the Bureau gave serious consideration to the effects of proposed programs on the welfare of people immediately concerned and on the national welfare. To this end, problems of evaluation were studied and procedures were developed for the accurate appraisal of flood damages, and of the benefits and costs of various flood-control measures and programs. The relationships involved are complex, and although many of the problems are comparatively new, progress toward their solution was made.

During the year, the Department of Agriculture agreed to make gross-area flood-damage and benefit appraisals at the request of the

War Department. Under this agreement, appraisals were made by the Bureau of Agricultural Economics on the Trinity and Brazos watersheds in Texas, Fountain Creek in Colorado, and on the Nooksack, Snohomish, Willapa, and Naselle watersheds in Washington.

The Bureau has technical responsibility for conducting the farm-management phases of watershed flood-control surveys that are being carried on cooperatively with the Soil Conservation Service and the Forest Service. Such phases include (1) a determination of the changes in farm inputs and outputs occasioned by physical adjustments for flood-control and erosion-control purposes, (2) an evaluation of the effect of such physical adjustments, (3) a determination of the most advantageous combination of productive enterprises consistent with recommended soil-conserving systems of farming which have flood-control significance, and (4) the formulation of programs for effective farm and ranch management to effect needed flood-control adjustments.

During the year personnel of the Bureau have been engaged in surveys upon the following watersheds: Coosa River, Ga., Muskingum River, Ohio, Kickapoo River, Wis., St. Francis River, Mo., Trinity River, Tex., Concho River, Tex., Washita River, Okla., Tallahatchie River, Miss., Rio Puerco, N. Mex., Fountain Creek, Colo., Los Angeles River, Calif., and Boise River, Idaho.

In water-facilities planning, 15 special reports were released, and area plans for 6 areas were completed for the guidance of operating agencies in the development of water facilities in various watersheds of the Western States. The water-facilities program has been in operation for only a short time. Accomplishments of the program thus far, however, indicate that the development of water facilities for stock and farmstead supplies, irrigation, ground-water replenishment, etc., are designed effectively to alleviate distress and to help promote a more stable agriculture in the semiarid West.

INFLUENCING THE USE OF LAND

In cooperation with farmers, agricultural experiment stations, and county officials, activities were devoted to analyzing the place of such measures as rural zoning, cooperative grazing legislation, and policies relating to tax-delinquent lands in accomplishing various objectives of a land use program. These social tools with which State and local people, working as a group, may control and protect individuals and the public from unwise land use have proved to be most effective. A study in Yellowstone County, Mont., together with other work in the State, helped in securing the recent enactment of a county land-management act and legislation for the improvement in the functioning of cooperative grazing districts. Similar activities in other States, as well as assistance rendered county planning committees, college research workers, and others, have resulted in a number of worth-while publications.

These studies along with informal advisory activities were contributing factors to the adoption of legislation designed to bring about a better relationship of people to the land in Montana, Minnesota, Indiana, Tennessee, Pennsylvania, North Dakota, and South Dakota.

FARMING AS WAY OF LIFE AND OF LIVELIHOOD

The farm population on January 1 was estimated by the Bureau at approximately 32,000,000 persons. There was a slight increase during the year, and the farm population now is close to the record farm population of 32,077,000 in 1910. Approximately 1,000,000 persons moved off the farms in 1938, whereas about 800,000 moved to farms from towns and cities. The net migration off the farms was more than offset by an excess of births over deaths on farms.

Effort is being made in cooperation with State agricultural experiment stations to improve the annual farm-population estimates, utilizing samples selected in different ways, different types of mailed questionnaires, and follow-up field surveys. Especial attention is being given to techniques that appear to combine the advantages of interviews in carefully selected sample areas with the simplicity and low cost of mail questionnaires.

Studies are being made of migration to and from the farms, of farm labor, of farm standards of living, of the needs for rural relief, of community organization, and related social aspects of farm life.

Studies are being made of rural opinions and attitudes, particularly as they relate to public-action programs. Cultural areas or regions of the Nation are being determined and analyzed.

Fourteen reports have been issued in the Social Research series (processed), two are about ready for publication, one has been published as a research bulletin by the Works Progress Administration, and one by a State experiment station. The large demand for additional copies of the publication, Disadvantaged Classes in American Agriculture, made a second edition necessary.

ADJUSTMENT AND THE FARM

A considerable part of the Bureau's work in farm management emphasizes fact finding and planning for agricultural programs. It aims to construct a more adequate factual and analytical foundation of knowledge regarding various farm situations and problems. The Bureau has undertaken to determine the economic problems of internal organization and operation of farms in problem areas and to appraise the relation and effect of various agricultural programs on these problems, as a basis for a better use of the farmers' resources in terms of economic welfare of farm families and of the Nation.

Farm-management research and planning studies in selected intensive counties and in uniform-program counties, were started in eight counties in six States. Plans have been or soon will be completed for similar studies in several more. Regional staffs of the Bureau assisted county planning committees and county planning officials throughout their sections in setting up technical procedures and collecting and interpreting available background data useful to local land use planning groups.

Studies in selected intensive land use planning and unified program counties are designed to supplement County Land Use Planning Outline No. 1, the working guide of county land-use planning committees, by: (1) A classification of farms in each adjustment problem area in the county by size, physical and economic resources, tenure, type of farming, and other characteristics that are correlated

with adjustment problems on individual farms; (2) an appraisal of alternative production possibilities from the standpoint of conservation and income expectancy for representative farms in each principal group—in view of general economic conditions, interregional competition, and the welfare of the farm population within the area and in other areas; and (3) an outline of suggested elements of practical action.

LAND TENURE

Research and planning activities in land tenure were developed on a somewhat expanded basis during last year. Particular emphasis was given cooperative work with State agencies seeking to improve landlord-tenant relationships through legislative action and education. Numerous research studies sought to develop basic information regarding land ownership and farm tenancy. Some additional research studies were initiated to meet increasing demands for information to guide both Federal and State programs dealing with farm-tenancy problems.

In Iowa, the State Legislature enacted into law three recommended adjustments: (1) The automatic continuation of all agricultural leases from year to year unless notice of termination is given prior to November 1; (2) the amendment of foreclosure procedure in order to protect the farm operator's tenure situation in years of crop failure or low prices by providing for postponement of the foreclosure action when default is brought about by reason of drought, flood, heat, hail, storm, or other climatic conditions or by reason of the infestation of pests that affect the land in controversy, or when the Governor of the State of Iowa, because of a business depression, by proclamation, shall have declared a state of emergency to exist within the State; (3) the appointment of a farm-tenancy committee to study further the farm-tenancy problem.

This work in Iowa has influenced many landlords to make desirable changes in leasing arrangements with tenants. One large life insurance company, owning many farms in Iowa, changed its practice of automatically terminating leases without notice. Now all leases are continued on an automatic-renewal basis unless notice is given on or before October 1 preceding the date of termination, or unless notice is given before December 1 preceding the date of termination and payment is made to the other party for disturbance.

In Arkansas, technical advice and guidance were supplied State officials in drafting the Land Policy Act relating to the classification of State-owned land and its disposition for the benefit of tenant farmers. Technical assistance was given to local authorities in setting up rules and regulations necessary to put this act into operation.

In Texas, at the request of State legislators and local authorities, technical assistance was given in the development of the Texas farm-tenancy bill which provides for many desirable changes in the present law governing landlord-tenant relations. The bill as drafted was favorably reported out by the agricultural committee of the house but failed to pass. It is believed, however, that the work has paved the way for the enactment of legislation providing for improvement in the present landlord-tenant law. Cooperation toward this end will be continued with local authorities.

Similar cooperative work in land-tenure improvement has been carried out in Oklahoma where a special landlord-tenant relationships department has been organized by the Extension Service to improve the farm-tenancy situation. A detailed analysis was made of the farm-tenancy situation in Oklahoma for publication by the State Agricultural Experiment Station. A study of the legal aspects of landlord-tenant relationships was made. Advice and assistance were given local authorities in Oklahoma in drafting the act passed by the State Legislature providing for the sale of State school lands to tenants.

Studies of the legal aspects of landlord-tenant relations in Texas, Arkansas, Oklahoma, Georgia, and Virginia involved library investigation of the constitutional provisions, statutes, and court decisions relating to landlord-tenant relations, a field survey to determine how existing law affects the day-to-day operations of landlords and tenants, and the development of recommendations for improvements in the existing law. Preliminary reports have been completed for Arkansas and Oklahoma. The library investigational phase of these studies has been completed for Texas, Georgia, Kansas, and Virginia. In Virginia, the field survey work has also been completed.

Numerous research studies were continued for the purpose of maintaining a current analysis of the farm-tenancy situation and to supply basic information to Federal, State, and local agencies engaged in farm-tenure improvement programs. Farmers' Bulletin 1164, The Farm Lease Contract, was revised. Reports approved for publication included Tenure Status and Land Use Patterns in the Corn Belt, Arkansas Farm Tenancy Situation, Recent Changes in Farm Labor Organization in Three Arkansas Plantation Counties, and Oklahoma Farm Tenancy Situation.

FARM MIGRATION

Since 1930 there has been a reduction in migration from farms and a consequent increase in farm population. This increase has been most marked in the poorer areas—those characterized by meager land resources, low incomes, and noncommercial farming. In some of the areas where commercial farming is most highly developed, including those affected by drought, there was a considerable migration away from farms—large enough to bring about a reduction in farm population in some places. Meanwhile, the high birth rates in some of the poorer farming areas are making themselves felt in correspondingly rapid increases in population. The young-adult age groups, which normally would have contributed the largest proportion of the migrants, showed the greatest increases, resulting in a "piling up" of persons in the productive ages.

The reduced migration from rural areas and the back-to-the-land movement have been important factors in intensifying rural-relief needs. Areas receiving large numbers of migrants in recent years, such as the far West, found the migrants a burden with which existing public agencies were unable to cope adequately.

A Bureau report on rural migration concludes:

> Experience indicates that migration offers no general panacea for the problem of rural areas. Unguided migration has not been effective in preventing the need for relief, and planned resettlement must necessarily be on a small scale

in terms of large numbers of poverty-stricken rural people. Rather, a combination of directed migration, reduced birth rates, and improvement of social and economic conditions in general within overpopulated areas seems to offer the soundest approach to solving the long-time problems of widespread need in rural areas.

A comprehensive study is being made of migration and resettlement problems in the Pacific Coast States growing out of the westward movement of distressed rural families from the Great Plains and the Cotton Belt during recent years. It seeks to evaluate the significance of this population movement for public policy and to afford a factual basis for Federal and State programs to aid and direct the resettlement of the displaced migrant group. The study is being made in cooperation with the Farm Security Administration, the agricultural experiment stations of Washington, Oregon, and Idaho, and the department of economics of the University of California. Field work and collection of data were completed at the end of June. Reports on various phases of the project are in preparation for release at intervals during the current fiscal year.

REGIONAL AND AREA ADJUSTMENTS

Studies of area agricultural adjustments were continued in 6 localities of the southern Great Plains. Four were undertaken to determine the minimum sizes and types of units for successful farming. One of these analyzed 100 small ranches to learn the extent to which it will pay small farmers operating under similar conditions in drought areas to go into the production of cattle or sheep.

In the northern Great Plains the farm-adjustment studies in Montana have been continued. The State has been divided into nine major type-of-farming areas presenting some degree of similarity in physical characteristics and farming types, and subsequent work has been centered on an appraisal of present conditions on Montana farms, their future outlook, and the degree of adjustment needed to bring stability and permanence in each of these major areas.

The Bureau cooperated with the South Dakota State College in a study of the present agricultural conditions in central South Dakota and the adjustments needed to place agriculture in the area on a more stable basis.

In the cotton States studies were made in the Yazoo-Mississippi Delta area, in the High Plains cotton area of Texas, and in Alabama and Georgia. The study of plantation organization and operation in the Yazoo-Mississippi Delta, completed during the year, shows that significant changes have been occurring during recent years in the use of labor and power and, consequently, in plantation organization and operation. The economic and social significance of these changes is analyzed and a foundation of information is developed upon which effective adjustments may be based.

Studies in the Northeastern and East Central States likewise have contributed to the fund of knowledge upon which permanent agricultural programs may be based. These projects dealt with tobacco farms in Virginia, truck farms in New Jersey, and dairy farming in Maine, Massachusetts, Connecticut, and Rhode Island.

Type-of-farming studies were made in Mississippi, Alabama, New Mexico, and Maryland.

To measure the physical and economic effects of the soil conservation program on the organization and operation of farms, 47 studies were under way in 17 States during the year. In these projects the Bureau cooperated with the Soil Conservation Service and the agricultural experiment stations in the States.

Range studies were conducted on three major fronts: In northeastern Nevada the cooperative economic study of range use was continued in order to work out the most feasible program for use of the natural resources of the area, and to develop an administrative program for the various Federal agencies involved. The study gives an accurate inventory of agricultural resources in the area, and an analysis of economic and physical forces affecting ranch operation and income. Information developed is of value to administrative agencies such as the Forest Service and the Division of Grazing and the Office of Indian Affairs of the Department of the Interior in developing an improved basis for the administration of public lands.

Farm-management work was nearly completed on the Perkins County, S. Dak., and the Tri-State (Texas, Oklahoma, and New Mexico) land-purchase projects. Studies were made in these areas to ascertain the sizes and types of farm units, and the farming practices, most likely to withstand drought periods, and adequately support a family; also to develop general guidance principles for adjustments in use of land for grazing on the projects. Studies were completed in Baca and Las Animas Counties, Colo. Soil-productivity indexes were prepared for eastern Colorado, western Kansas, and the Oklahoma Panhandle to serve as a guide for the land-purchase and other programs.

FACTORS IN RURAL LIVING

Studies in standards of living generally indicate that one of the most practical methods of raising the level of living of farm families is through the greater production of goods for home use. The families with the smallest cash income—total or per capita—also reported the smallest quantity of home-produced goods and as incomes increased the value of home-produced goods also increased. Increased cash incomes resulted in greater expenditures for health, education, and other so-called advancement expenditures, which are also the ones most likely to be curtailed as cash incomes are decreased.

Effort is being made to develop indices of standards of living to be based on a small number of relatively simple items, the data for which might be obtained currently at small expense.

Twenty-five thousand usable reports relative to the extent of combine use, binder use, and other methods of harvesting wheat and oats, and the custom rates for combining and threshing, were received by the Bureau in response to a questionnaire sent to crop reporters. Data were obtained on the extent of use of the mechanical corn picker and custom rates for its use. Analysis of this information is still under way.

A study of the effect of use of tractors on farm-organization and farm-management problems recently was undertaken in five type-of-farming areas in Minnesota. Studies were completed on machine duty and crop-production practices on approximately 2,400 grain

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farms in the major wheat areas of the Great Plains and the Pacific Northwest.

In several studies designed to develop an improved basis for rehabilitating and resettling farmers so they can make a living and pay for their farms, the Bureau cooperated with Federal and State agencies. These studies related to rehabilitation clients of the Farm Security Administration in Minnesota; to settlement of farmers on the newly developed Vale and Owyhee irrigation projects in Oregon, and to a proposed irrigation project in Jackson and Greer Counties, Okla.; to settlers on cut-over lands in western Washington; and to possibilities for rehabilitating farmers in the Great Plains region.

AGRICULTURAL HISTORY

Special interest has been shown during the year in the historical background of the Nation's agricultural problems. A committee of historians from different sections of the country met in Washington May 22–24 and recommended an expansion of the agricultural history unit as well as the historical activities of the agricultural colleges and experiment stations. It is planned to carry out this recommendation. Progress has been made in the research on the development of dairying in the Northwest, with a view to supplying a sample monograph of what is needed for all commodities and regions.

The following historical bibliographies were issued or reissued during the year: References on American Colonial Agriculture, References on Agriculture in the Life of the Nation, Selected References on the History of Agriculture in the United States, List of American Economic Histories, References on the Significance of the Frontier in American History, and References on the History of American Agriculture. New and enlarged editions of the bibliographies called References on Agricultural Museums, and Selected References on the History of English Agriculture have been prepared for publication.

FARMERS IN A YEAR OF ABUNDANCE

Nineteen thirty-nine is another year of abundance of food, feed, and fibers. Total crop production was smaller this year than last, but only slightly below the predrought average. The supply—production plus carry-over—is more than enough for normal domestic requirements and prospective sales abroad. Most areas except the drought-stricken sections of the Northeast, Nebraska, Kansas, and parts of the Southwest, have had good yields of crops this year. As this report is written more than 12,000,000 farm-family workers and hired hands are harvesting fall crops.

Livestock production was larger this year than last, and was approximately at the levels of predrought years. In terms of food supply, the increase more than offset the smaller yields of crops. Each animal unit produced more, and there were more livestock on farms. Products include meats, lard, wool, eggs, milk, butter, cheese—all in plentiful supply at relatively low prices. Livestock production has been increased during recent years as feed became more plentiful and low priced, following the droughts of 1934 and 1936.

The financial results of the year's production of crops and livestock products are summed up in this Bureau's estimates that 1939 cash farm income (including income from marketings, Government loans on farm commodities, and Government conservation and parity payments) will total about $8,300,000,000. This compares with about $8,100,000,000 in 1938, and with $9,100,000,000 in 1937—the peak of the recovery period. The depression low was $4,682,000,000 in 1932. The 1939 income will be about 80 percent larger than in 1932.

The estimates for the various items will be summarized, and the Bureau expects to publish a revised series of estimates of gross and cash are fractionally lower this year than last, the purchasing power of farm income was slightly larger than a year ago. Nevertheless, prices of commodities bought by farmers continue approximately 20 percent above pre-war prices, whereas prices received by farmers are 10 percent below pre-war prices.

ESTIMATING FARM INCOME

Estimating farm income is a major research project. The Agricultural Adjustment Act of 1938 requires a comparison of per capita net income of individuals on farms from farming operations with per capita net income of individuals not on farms. This required an intensive study of the basic data used in estimating farm income and expenditures. Revisions of former series were needed to provide a measure of income parity. During the year, the Bureau has published income estimates for the period from 1910 to date on most of the principal farm products.

The estimates for the various items will be summarized, and the Bureau expects to publish a revised series of estimates of gross and cash income from agriculture in the United States from 1910 to date, on the calendar-year basis. Estimates of farmers' expenditures for fertilizer and feed, and other commodities used in production, cost of hired farm labor, depreciation and value of farm buildings, and purchases and depreciation and value of automobiles, motor-trucks, tractors, and other farm machinery, estimates of medical service rates to farmers, rates for electricity for farm home and farm power, telephone rates to farmers, rural passenger fares, and prices of tobacco products, prices of newspapers, and rates for hired household help, theater admissions, and barbers' services are some of the statistical series that have been completed for this project.

Additional research work has been done in combining the various reports on nonfarm sources of income of farmers and in estimating the national income of persons not on farms back to 1909. Because of the lack of a comparable series of data on national income since 1909 and the various concepts of income used in income studies, much research work is involved in making these estimates comparable over the entire period and in adjusting the concept of national income to coincide with that of the estimates of income from agriculture. A general revision of index numbers of prices received by farmers has been practically completed.

The Bureau continued its annual inquiry into the cost of producing corn, wheat, oats, and cotton. Studies of farm returns were continued. The Bureau explored the possibilities of constructing

index numbers to show changes in farmers' costs and returns. A special report on Production Costs and Returns, dealt with: (1) Public and private interest in farm production costs, (2) cost objectives, (3) methods and problems of computing costs, (4) three types of cost-price relationships, and (5) costs as a basis for price fixing. The last-named section discussed considerations in determining a "fair" cost-price relationship, the influence of price if set at different cost levels, the relationship between costs and profits, and historical costs as a basis for price fixing.

FARM VALUES AND MORTGAGE DEBT

Other indices of agricultural economic welfare include the maintenance of farm real-estate values at approximately the recovery levels of recent years. As of March 1, the Bureau's index of farm real-estate values was 84 percent of the 1912–14 period. This was a decrease of about 1 point from the 1938 figures, but it was the first decline in 6 years, values having increased about 4 percent each year from 1933 to 1938. The rise in values during recent years seems conservative in view of the much larger gains in farm incomes.

The farm-mortgage debt has declined moderately in recent years and now is approximately $7,000,000,000. This represents a decrease of more than $2,500,000,000 during the current decade. About 40 percent of the farm-mortgage debt is held by Government or Government-sponsored agencies, the remainder by insurance companies, commercial banks, and other private agencies. Figures show a reduction of nearly 27 percent in mortgage debt since 1930, but a much larger decrease in annual interest charges. Foreclosures and related distress transfers on mortgaged farms continue an important cause of debt reduction, but voluntary repayments have been of increasing importance in recent years.

Besides annual surveys of farm-mortgage debt, the Bureau is compiling estimates of outstanding farm-mortgage debt and average interest rates, by States, for each year back to 1910. Previous mortgage-debt estimates at census years are being revised to take account of new information obtained in the 1935 cooperative farm-mortgage survey and in the farm-mortgage and transfer project of the Works Progress Administration. Estimates are being made of outstanding farm-mortgage debt for intercensal years and estimates of average interest rates for all years based on W. P. A. project data.

A series of State releases based on the W. P. A. farm-mortgage and transfer project was completed. These present annual data by lending agencies (1917–35) on (1) the percentage of mortgages filed by the principal lender groups, (2) the average size of newly recorded mortgages, and (3) average interest rates on newly recorded mortgages. The State reports are being consolidated into regional and national totals, and indices are being prepared on the volume of mortgage recordings. These series will be available during the 1940 fiscal year. There was a slight decline during 1937 in holdings of farm real estate by leading lending agencies following the continuous increase in such holdings after 1929.

Exploratory work has been begun in a study of the farm-mortgage-credit characteristics of selected types of farming areas. Survey data compiled by the Bureau and data from the W. P. A. farm-mortgage and

transfer project have been analyzed to aid in the isolation of the characteristics of farm-mortgage financing peculiar to certain types of farming areas. Such an analysis of relatively homogeneous areas makes possible a better appraisal of farm-mortgage problems than can be accomplished on the basis of data for States and geographic divisions.

An analysis was made of the census data on the percentage of owner-operated farms mortgaged as shown in the several census reports, and estimates by States of the percentage of such farms under mortgage were made for each census year from 1890 to date. Analysis was made of the data on frequency of mortgage debt obtained in the 1935 cooperative survey to determine the proportion of full-owner operators owning land in addition to that operated by them. It is estimated that about 15 percent of the full-owner operators own additional land which they rent to others, that in 1935 about 33 percent of these farm owners had mortgage debt as compared with 40.7 percent of those who owned no additional land.

SHORT-TERM CREDIT

Farmers' short-term debts on account of personal and collateral loans by commercial banks and loans of a similar type held by federally sponsored credit agencies totaled $1,255,185,000 as of December 31, 1938. Loans to farmers by commercial banks increased during the last half of the year; loans by federally sponsored credit agencies declined. The combined holdings of the two groups of lending agencies were 28 percent higher than at the end of 1937. The increase in 1938 reflected in part the substantial volume of advances made by commercial banks under the Commodity Credit Corporation loan program.

The Bureau is trying to find ways in which country banks may serve more satisfactorily as agricultural credit institutions, and to find ways to lessen the problem of idle capital in agricultural districts. A study of country banks in Wisconsin was completed during the year, and work is well advanced on a similar study in Utah. The Wisconsin survey indicated possibilities of country banks increasing protection to depositors and providing more dependable credit services to local borrowers. There seems to be urgent need for a modification of obligations of country banks to time and savings depositors, so that these banks may be relieved of responsibility to pay such depositors on demand or at short notice. Much improvement can be made also by altering bank policies with regard to investments in securities.

Demand deposits of country banks afford a sensitive index of changes in farm-purchasing power. In the last half of 1938, such deposits in seven Corn Belt States and in eight range States reached the highest level of the recovery period. Personal and collateral loans to farmers by insured commercial banks increased during 1937 and 1938, the total rising from $593,614,000 on December 31, 1936, to $1,064,667,000 at the end of 1938. Short-term agricultural loans of a similar character by federally sponsored agencies rose during 1937 from $170,271,000 at the end of 1936 to $192,480,000 at the end of 1937. By the end of 1938, such loans had fallen to $190,518,000.

Projects now being developed by the Bureau are designed to determine the debt adjustments and modifications of credit policy needed

to help farmers—particularly in distressed areas—to adopt soil-improvement practices and adjust their production systems. It is hoped, also, that through participation in the program of county planning, farmers may be encouraged to plan their use of credit more carefully so as to avoid unprofitable borrowing and excessive indebtedness.

FARM TAXES AND LOCAL GOVERNMENT

Farm real-estate tax levies rose slightly from 1934 to 1937. The 1938 levies were approximately equal to those of 1937, and preliminary indications are that those of 1939 will be on about the same level. The 1938 levies averaged 186 percent of the 1909–13 base, as compared with 187 percent in 1937, 178 percent in 1934, and 281 percent in 1929. In relation to gross farm income, taxes fell from 1932 to 1937. The comparison of real-estate taxes and farm income must be interpreted with caution, however, because it omits a vital factor—the increase in other taxes, such as automobile and fuel and general-sales taxes.

Several factors operated to make possible the slackened rate of increase in farm real-estate taxes during the decade of the 1920's and the decline during the period 1929–34. Local and State governments were increasing their debt much faster during the 1920's than during the preceding decade. Federal aids for schools and roads were increasing. State aids financed from other sources than property taxes were increasingly supporting local services. Between 1920 and 1934 these sales and license taxes built up an annual charge against farmers of perhaps 150 million dollars, while farm real-estate taxes decreased by about 100 millions. It thus becomes apparent that real-estate taxes no longer constitute the preponderant part of the farmers' tax problem. Other factors in the situation need analysis. As one phase of the analysis, historical series of farmers' annual payments in each major type of tax are being developed.

A recent development in real-estate taxation of importance to farmers is homestead tax preference. Since 1933 it has been put into operation in 13 States, and its significance is the subject of extensive debate. Theoretical analysis must follow the peculiarities of specific laws, and final interpretation must wait for the adjustments in administration and taxpayer attitudes to take place.

Farm real-estate-tax delinquency has decreased since the depth of the depression but its effects will probably continue for a long time. The critical fiscal situation that delinquency developed in many rural jurisdictions during the depression called attention to fundamental maladjustments in the governments and economy of rural communities. There is some danger still that planning for stabilization of local resources and income will accept tax delinquency too largely as a causal factor in the problem, that it will rely too largely on delinquency as a criterion of appropriate or inappropriate use, ownership, organization, and public-control policies. Like other elements in the farmers' tax situation, this subject needs further analysis and exposition.

Important area studies are being conducted in the field of local government and finance. In agricultural areas, farm property comprises the principal source of rural taxable values, and changes in relationship between the people and land resources involve changes

in needs for public services, the type of local organization to supply these services, and the amount, kind, and distribution of fiscal resources that may be drawn upon to support them. Changes in intensity of land use and changes in settlement, as in the case of shifts from a dry-farming to a grazing economy, mean drastic revisions in tax base and in costs and location of such public services as schools and roads, and in the kind of districts to supply them.

A number of specific county analyses in areas of major land use problems were completed. These dealt with such specific matters as (1) reorganization plans for county government, (2) development of programs for use and disposal of tax-reverted lands, (3) utilization of tax-deed lands by grazing associations in areas where an adjustment from dry farming to ranching is occurring, (4) effects of public land-purchase and flood-control programs upon local government revenues and services, and (5) revision of assessments on lands used for grazing and suited only for that purpose.

Analysis was made of specific effects of the Federal land-purchase program upon local government. The findings are being used by a Departmental committee to formulate a uniform policy regarding contribution to local government for tax loss on all federally-owned lands administered by the Department. Members of Congress, local officials, and the branches of the Department concerned have expressed interest in more equitable adjustment of the problem.

In southeastern Colorado, a tax-assessment survey was made relating assessments to current productive value by land classification. One county actually reassessed along these lines, correcting a situation in which land used and suited only for grazing was long seriously over-taxed as farm land. The tax commission became interested and further work is planned in that State and in neighboring range States. Readjustments in assessments on range land have considerable significance in promoting land-use adjustment.

In Billings County, N. Dak., the county commissioners petitioned for a survey of the interaction of local finances, land use, and the land-purchase program in the county. Serious fiscal difficulties arising from the land problem prompted the request. Concurrently with the survey, representatives of the Bureau collaborated in the drafting of important State legislation, which was passed, enabling reorganization of county government. The findings of the survey are now being used for local discussion and action. Further work is in demand in North Dakota, Missouri, and other States where county planning groups offer the medium for purposive discussion and adoption of practical solutions for serious fiscal and governmental organization conditions related to land-use problems.

In Yellowstone County, Mont., a survey of the Buffalo Creek grazing district was made in cooperation with the State college, the county planning committee, and members of the cooperative grazing association. It presented the interrelationships of grazing associations, rural zoning, public-land purchase, the agricultural-adjustment program, and the management of tax-reverted county lands. The operation of the grazing association as a device for land-use adjustment in the Great Plains was analyzed. Detailed recommendations resulted for grazing legislation and association procedure, rural zoning, tax adjustments, modification of the agricultural-conservation pro-

gram, and management of tax-reverted lands. This ground work has already led, among other movements, to introduction of bills for administration of county tax-deed lands in Montana, North Dakota, and South Dakota.

In administration of the Bankhead-Black Act, 1,550 agreements were concluded with local taxing districts whereby payments in lieu of taxes would be made on extensive tax-exempt property holdings of the Farm Security Administration. New administrative procedures were developed and State legislation was obtained to assist efficient administration of the act. In addition to valuation of extensive resettlement-project properties for purposes of making the payments, practical problems involving applied research were solved. These included formation of new school districts, incorporation of villages and towns, and provision of public services and facilities to new aggregations of settlement by these and existing local units.

A departmental committee continued deliberations on a uniform plan of contribution to local governments because of tax exemption of land acquired and administered by various agencies of the Department. Problems arising from the extensive public-land purchase under the land-utilization program and needed changes in Forest Service provisions on this subject prompted the consideration of such a plan. Detailed factual surveys on various land-utilization projects, showing effects of the public-purchase program upon local government finances and services were of material assistance in the work of the committee.

During the year the Bureau has directed effort so far as possible toward (1) annual estimates, 1924 to date, of all major taxes paid by farmers or farm business, (2) better understanding of recent movements in taxation as they affect farmers, (3) study of individual problem areas with a view to recommending local government and taxation modifications in line with the national program for improved land use and stabilization of rural communities, (4) further development of policy regarding payments in lieu of taxes on extensive tax-exempt holdings of Federal agencies, and (5) presenting in articles and otherwise the questions regarding such aspects of the farmer's interest as discussion of public finance often seems to overlook.

FACT-FINDING FOR THE PEOPLE AND THEIR GOVERNMENT

Public and private agencies continually ask the Bureau to make statistical and economic studies dealing with many current agricultural problems. Activities during the year included a survey (at the request of the dairy statistics committee of the Northwestern Dairy Conference) of dairy-statistics work by public agencies of the Northwest. Results of this survey and suggestions for improving the dairy-statistics program were included in a report to the committee.

A report was published on world production and international trade in butter and cheese, and a manuscript for a technical bulletin was completed on the production and consumption of manufactured dairy products. A report of a joint project with the New York State College of Agriculture on the demand for milk, cream, and evaporated milk in the New York City market showed that although prices of milk and cream on retail routes were uniform and rather stable, retail

prices in stores were variable and were lowest in low-income areas and highest in high-income areas.

Other studies dealt with the tendency of production of protein by-product feeds to increase in relation to the production of feed grains, the effects of oleomargarine taxes on the consumption of oleomargarine and butter, the increase in consumption of evaporated milk in relation to consumption of fresh milk and cream, and the per capita consumption of manufactured dairy products. (In 1938, the per capita production of manufactured dairy products was the highest in more than 40 years.)

A mimeographed publication, State and Federal Legislation Relating to Oleomargarine, issued in June 1936, was brought to date and reissued. It outlines the historical background of margarine legislation, summarizes the State and Federal laws and regulations respecting margarine, and analyzes some effects of State legislation. It showed that the number of retail dealers of margarine had declined on the average by 51 percent in States enacting a 5-cent excise tax on the production, by 91 percent in States enacting a 10-cent tax, and by 99.8 percent in States enacting a 15-cent tax. The consumption of oleomargarine in the States affected has been considerably reduced by the enactment of State taxes in recent years.

DEMAND FOR STATISTICS

The unsettled and rapidly changing domestic and foreign economic situation of the last decade has brought a steadily increasing demand for statistical information and statistical and economic analyses of agricultural problems. The Bureau has organized a central statistics service which brings together all statistics relating to agriculture, so that anyone not entirely familiar with sources of such data may obtain from one agency the best and most complete obtainable information. The aim of this service is to make readily available all statistical information relating to agriculture for the use of research workers, administrators, legislators, and the general public.

During the year the Bureau was called upon to furnish many special analyses of current problems for the use of Government administrative officers, Members of Congress, farm organizations, agricultural businessmen, and others. These analyses have included the effects of actual and proposed legislative measures and administrative policies, tariff problems, and the effects of changes in domestic- and foreign-demand conditions in relation to changes in prices and incomes received by farmers. Many special commodity analyses were furnished. The regular series of monthly situation reports, of which 12 were issued each month covering the several commodities and the general price situation, also contributed to keeping administrators, legislators, and the public abreast of the rapidly changing current economic situation affecting agriculture.

CROP INSURANCE

Wheat growers were insured this year against unavoidable hazards affecting crop yields. Using actuarial bases developed by the Bureau, the Federal Crop Insurance Corporation wrote more than 163,000

policies in 1,289 counties in 31 States. Premiums of about 7,000,000 bushels of wheat were collected to insure the production of about 70,000,000 bushels. The Bureau is studying current problems in connection with the wheat-crop-insurance program, to determine the effect of improved farming practices on insurance rules, the extent and cause of wheat-crop losses, whether the actuarial basis is satisfactory and equitable, how to broaden the actuarial base period as additional yield data become available, and the economic and social results of crop insurance.

The Federal Crop Insurance Act provides for research to determine the feasibility of extending the benefits of crop insurance to producers of other crops. A plan for insuring cotton crops has been developed by the Bureau and published in outline—A Suggested Plan for Cotton-crop Insurance—as House Document No. 277, Seventy-sixth Congress, first session. Basic features are similar to the wheat-insurance plan in that the cotton farmer would be offered protection against losses in yield due to unavoidable causes. Premiums and indemnities would be determined in lint cotton and payable in cotton or the cash equivalent. Reserves accumulated out of premiums would be carried in cotton.

County cotton-loss experience figures are being determined on the basis of average loss experience on sample farms during a representative period of years. Research to determine these county average loss-experience figures, based upon yield data for sample farms supplied by State and county offices of the Agricultural Adjustment Administration, has been completed for more than 950 cotton-growing counties. Further work is necessary, however, in checking and testing the data, and in adjusting figures to reflect the experience during a more representative period, probably the years 1928–38. Crop-loss experiences indicate that premiums in some counties may average as high as 25 pounds of cotton per acre, in others as low as 5 pounds—for insurance up to 75 percent of the average yield.

An important feature of the plan for cotton-crop insurance is the provision for insurance against losses in yield of cottonseed as well as lint cotton. It was recommended in the proposed plan that all premiums and indemnities for loss of lint cotton be increased by a percentage which on the average, over a period of years, reflects the proportion that cottonseed represents of the lint-cotton returns. This provision would offer protection against losses of cottonseed as well as lint losses by the use of actuarial data which are available only in terms of lint. (At the time this report was prepared the Senate had passed legislation to extend the crop-insurance program to include cotton as well as wheat.)

Research work has been continued on crop insurance for corn and certain fruits. Annual corn-yield data for sample farms in a few representative counties in the Corn Belt were obtained by a field survey, and computations made of yields and necessary premium rates for these counties. Further study was made of similar data covering more than 100 counties, by a mailed questionnaire in 1936. Early indications are that average county premiums might range from 1 bushel per acre in some areas to 3½ bushels in others. A plan for corn-crop insurance will be developed as additional data become available.

FOOD-STAMP PLAN

Several possible marketing devices that might be used either to make agricultural surpluses available to low-income families at reduced prices, or which would give these families an increased purchasing power for foods have been studied by the Bureau. The food-stamp plan, now being operated on an experimental basis by the Federal Surplus Commodities Corporation, is one outgrowth of these studies. This plan gives to certain low-income groups an increased purchasing power for foods and an incentive to use the additional purchasing power to increase their purchases of surplus commodities.

The Bureau is now making a study of the economic and social effects of the food-stamp plan. It is continuing to study several other possible marketing devices which might be used to move surplus foods or other surplus farm products. The objective is to find practical, efficient, and inexpensive methods of dealing with farm surpluses in ways that will be effective in raising farmers' incomes and benefit the general public through improving nutrition and health.

FLAXSEED AND THE TARIFF

A study of flaxseed prices and the tariff was made in response to Senate Resolution 167, Seventy-sixth Congress, first session, and published as Senate Document No. 62. The primary purpose was to ascertain why flaxseed prices have been below parity since 1920. The study showed: (1) That world production of flaxseed and feeds was greater in the post-war than in the pre-war period; (2) that the use of oils other than linseed oil in paints, varnishes, and linoleum had increased; (3) that the margin between farm and retail prices of farm products was widened as a result of processing and transportation costs during and immediately following the World War; and (4) that there was no significant increase in the world demand for drying oils in the post-war period compared with the pre-war period.

It was found that prices of flaxseed in the United States have been higher than they would have been otherwise, because of the increases in the tariff on flaxseed in 1921, 1922, 1929, and 1930. Since 1930 the tariff on flaxseed, after allowing for the effect of the tariff drawback on exports of products manufactured from imported seed, was about 90-percent effective in raising flaxseed prices in the United States; 10-percent effective in lowering flaxseed prices in other countries.

Other research included studies of the incidence of the processing tax on coconut oil, the effect of imports of cashew nuts on the production and price of domestic nuts, and the effect of removing the duty on hairy vetch seed.

Material was prepared for use at congressional hearings on proposed legislation for increasing taxes on imported fats and oils. The analysis indicated that, although the price of domestically produced cottonseed oil, soybean oil, tallow, and grease, would be increased somewhat as a result of the proposed increase in the taxes on imported oils, the amount of this increase would be materially less than the increase in tax. The price of lard would be affected even less, and that of butter would be affected scarcely at all.

SUGAR, CITRUS FRUIT, AND COTTON STUDIES

Primary factors affecting the consumption of sugar in the United States were analyzed. It was indicated that annual total consumption is closely associated with the average wholesale price of refined sugar and the level of income of industrial workers. Results of this study were used extensively as an aid in determining the annual sugar-marketing quotas under the Sugar Act of 1937.

A special report on the world citrus situation was prepared at the request of the citrus producers in the United States. It revealed widespread expansion in production of oranges and grapefruit in the last two decades, and indicated prospects for continuing expansion in the next 5 to 10 years. Production of citrus fruits has increased most in the United States, Brazil, Palestine, Japan, and the Union of South Africa. It is expected that exports of oranges and grapefruit from Palestine and the Union of South Africa will increase sharply during the next few years. This means increasing competition with United States citrus fruits in foreign markets.

A study of Japanese uses of American cotton and foreign uses in general of American cotton during the last few years showed that from 1903 through 1933, there was a net increase of 1,700,000 bales in consumption of American cotton by Japanese mills, an increase of nearly fourteenfold, and the equivalent of an average annual increase of nearly 60,000 bales. This increase resulted in part from the expansion in Japanese industry and in part from an increased proportion of American cotton used.

Since 1933, consumption of American cotton has declined in Japan 1,000,000 bales, or 50 percent. From 1933 through 1937, a decline of about 500,000 bales occurred, despite an increase of nearly 1,000,000 bales in consumption of all cotton, and American declined from 63 to 35 percent of the total. Changes in relative supplies of American and foreign commodities appear to be the important factor in the situation during this period.

Japanese consumption of American cotton declined an additional 500,000 bales during the last 2 years. This decline appears to have been due largely to the Sino-Japanese conflict which brought Japanese allotments of foreign exchange, restrictions on the use of cotton by Japanese consumers, and increased imports of the goods that are considered more essential for military needs.

A study of the effects of currency depreciation in the United States and in foreign countries on cotton price and on acreage in these countries indicated:

(1) Currency depreciation in the United States and the important foreign countries which were studied no doubt caused the price of cotton in those countries to be higher than it would have been had the currency not been depreciated.

(2) The extent of the depreciation of the currency of a given country, the number and importance of other countries whose currency was depreciated at approximately the same time, the extent of the depreciation of the currency of cotton countries, and the importance of the country as a consumer of cotton are the important factors determining the extent to which currency depreciation affects cotton prices in any given country.

(3) The effects on cotton acreage differed from country to country, not only because of differences in the effects on cotton prices, but also because of the extent to which the prices of alternative products were affected and the extent to which producers responded to price changes. In Egypt and southern Brazil, grain and coffee prices respectively are important factors affecting cotton acreage.

(4) In the United States, it seems probable that the cotton-adjustment program prevented the increase in domestic cotton prices (resulting from depreciation of the dollar) from increasing cotton acreage to any significant extent.

STUDIES OF PRICE FIXING

An analysis was made of the probable cost of carrying out the provisions of a bill providing for price fixing applied to domestically consumed farm products. The total cash outlay by the Government in administering the provisions of the bill, it was found would be prohibitive and tremendous difficulties would be encountered in attempting to put the bill into operation.

An analysis was made of the activities of the Federal Government in aid of agriculture bordering on price fixing during the period 1933–38. It was found that only a few such measures might be termed price fixing, as clearly defined, but that several have had features bearing an outward resemblance to it, or in actual operation have had effects similar in some respects to those of outright price-fixing measures. Such measures in aid of agriculture were found in connection with tobacco, dairy products, peanuts, rice, sugar, and other commodities.

Analyses were made of various export-dumping plans, and of the effects of the wheat-export subsidy, and probable effects of the cotton-export subsidy upon prices and incomes received by producers of these commodities and upon world prices. It was found that the wheat-export subsidy has operated mainly to increase domestic prices rather than to lower world prices. The Bureau contributed extensively to a report on tobacco exports prepared in response to Senate Resolution 291 and published as Senate Document No. 39, Seventy-sixth Congress, first session.

FOREIGN TRADE IN MEATS

A study of trends in foreign trade in meats and livestock and of their relation to trends in domestic meat and livestock production was practically completed during 1938–39. This study indicates that one of the most important problems confronting livestock producers is the finding of foreign outlets for 500 to 600 million pounds of lard every year, approximately 25 percent of our lard output, or making adjustments in hog production which will result in the production of less lard. For a long period of years before the 1934 drought, domestic production of lard exceeded domestic consumption by a considerable margin and from 25 to 35 percent of our lard production was exported. Nearly one-third, or about 200 million pounds of the total United States exports usually went to Germany. Since 1933, Germany has taken practically no American lard, and it does not appear probable that it will take any in the next few years.

With prospects for a recovery in hog and lard production to pre-drought levels in 1940 and with little likelihood that foreign markets will take nearly so much lard as before 1934, it appears probable that the domestic market will have to absorb a much larger-than-average quantity of lard. The situation is further complicated by the fact that the domestic production of edible vegetable oils that compete with lard is now from 300 to 400 million pounds larger than before the drought. Most of this increase is in soybean oil. Consequently, the domestic supply of lard in the next few years will be in excess of the

usual domestic-consumption requirements and probable export outlets by about 200 million pounds and, in addition, the volume of domestic vegetable oils used for essentially the same purpose as lard will be 300 to 400 million pounds greater than in the decade before the drought. Although the increase in population during the last 10 years will offset in part the increase in total output of lard and vegetable oils since the predrought period, per capita supplies of these products in 1940 will be much larger than they were previously. The increase in lard this year and the prospective larger domestic output of lard and other fats and oils next year have already been reflected in a marked decline in the price of lard.

From a long-time standpoint, the situation for pork and other meats is much more favorable than for lard. Exports of pork, although relatively large for many years, were never so large in relation to the domestic production of pork as in the case of lard. Although prospects for recovery in the foreign demand for pork to anything like the levels of the 1920's are very unfavorable, the increase in population will make it possible for the domestic market to absorb a larger quantity of pork than before 1930.

The situation for all meats is much the same as for pork. The ratio of meat production to population has been declining for more than 30 years. Per capita meat consumption, however, has not declined so much as per capita meat production because exports of meats were decreasing in most of this period. During the last few years, meat exports have been small and have been about offset by meat imports. Some further increase in population seems probable during the next several decades, and unless meat production increases, the per capita production of meats may decrease further. But the trend in meat production may be upward in the next decade because of the shifts in acreage of cash crops, especially cotton, to feed crops and pasture. This increase will probably be no greater and may be less than the increase in population in the next 10 years.

FROM FARMER TO CONSUMER

The Bureau has instituted a stronger and revitalized program of research dealing with the marketing and transportation of farm products. The importance of this research is obvious. The total money spent each year for the services of transporting and marketing agricultural products is greater than the total income received by farmers. The farmer gets for his work less than half the money spent by consumers of foods and other commodities made from farm products.

Policies of the Federal and State governments should promote and encourage an efficient and effective marketing system. Any substantial improvements in this direction would be of great benefit both to the farmers and to the consuming public. But this requires more than the usual detailed and technical marketing studies. It requires a rather general evaluation of the marketing system as a whole and a broad consideration of the economic and social effects of alternative policies in marketing and transportation.

Marketing programs and policies of the Federal, State, and municipal governments are being studied. The economic and social effects of the policies being followed in providing governmental marketing

services and in regulating marketing methods and practices are being evaluated in the hope of contributing to the development of a program intended to provide for more efficient marketing and to benefit both the farmers and the consuming public. The marketing work of governmental agencies includes three general fields: (1) Services such as market news, standards, and inspection; (2) the participation of the Government in action programs intended to dispose of farm surpluses and in general to provide for more orderly marketing; and (3) regulation, such as the enforcement of the Commodity Exchange Act and the various State and municipal regulations dealing with such matters as milk inspection.

American agriculture traditionally has taken active and widespread interest in the economic problems of transportation. With production of many farm products in specialized areas and consumption of these products concentrated in the populous East, the frequently great distances from farm to market constitute significant economic barriers to the marketing of farm products advantageously from the standpoint of farmers and consumers. Farmers must have at their disposal transport services that are efficient and adequate in terms of speed, protective qualities, and the necessary quantities of particular services at rates that are low enough to enable farm products to move to markets and thence into the channels of consumption without delay and the piling up of agricultural surpluses.

A development in line with the long history of farmer agitation for more adequate and more economical transportation service from farm to market was the establishment in the Department of Agriculture in 1938 of general economic research into the basic problems of transporting farm products. The general objectives of this program include assembling relevant facts regarding rates and practices applying to the transportation of farm products and the factors influencing movements in freight rates; studying the economic effects of transportation rates and practices upon farm production, prices, and income; appraising the implications of technological changes affecting the transportation of farm products, such as the development of trucking; and considering public policies with respect to promotion and regulation of transportation with a view of suggesting policies that will reduce the economic barrier of distance between farm and market and promote higher levels of farm income and general employment, production, and consumption.

This transportation program was authorized by Congress in section 201, title II, of the Agricultural Adjustment Act of 1938, which provides authority for the Secretary to enter cases before the Interstate Commerce Commission involving rates, charges, tariffs, and practices relating to the transportation of farm products, and to assist farm cooperatives in making complaint to the Commission with respect to such cases. These functions were assigned to the Bureau of Agricultural Economics to administer for the Secretary.

The approximately 600 million dollars of revenue that the steam railroads of the United States derived from transporting agricultural commodities in 1937 and the large, though undetermined, sums received by express companies, water lines, and motor carriers for transporting farm products and supplies explain the great concern of agricultural shippers in the formulation of national transport

policies and in fluctuations of freight rates. This concern reached a high pitch during the last 2 years because of the recent general increase of 5 percent in rail rates on agricultural products and further increases on specific farm products such as livestock and cotton.

TRENDS OF MARKETING

Costs of marketing have increased over a period of years, leaving smaller proportions of the consumer's dollar for the farmer. What is the cause of this trend? Is it necessary? In recent years large-scale business enterprises—chain stores, meat-packing plants, and large dairy companies—have been handling a larger proportion of the farm products, often receiving these products direct from producers. Is this an efficient method of distribution? Will it continue? Will it result in monopoly? If so, should the monopoly be broken up or regulated?

Export markets for many of our products have been declining. Cotton exports are the smallest in 50 years. What is the cause of this trend? Can it be counteracted, or must production be adapted to new conditions? Farm products formerly moved to market largely by rail. Ever-increasing quantities are now moving by motortruck. How important is this trend and what adjustments are necessary to adapt ourselves to it?

The above questions indicate the types of studies that are necessary in order to find out where we are headed in our production and marketing of farm products, and to adapt ourselves to the constant changes that are taking place either by taking the necessary steps to counteract these trends or by modifying our activities to adjust ourselves to them. The discovery of these trends, the explanation of them, and planning the necessary adaptations, or programs, for dealing with them are important fields of activity of the Bureau.

NEW MARKETS FOR OLD

An important project during the year was a study of the wholesale fruit-and-vegetable markets in New York City, made at the request of Mayor LaGuardia, the California Fruit Growers' Exchange, the Florida Citrus Exchange, the American Fruit Growers, and a number of other trade and farm organizations. This study has not yet been completed but indications are that from 6 to 7 million dollars can be saved annually in the cost of handling fruits and vegetables in the markets of New York City. Accomplishing these savings will require extensive changes in the existing market set-up. Requests for studies have come from many additional cities.

BETTER MARKETS FOR PERISHABLES

Interest has continued to increase in the Bureau's studies dealing with the improvement of organization, facilities, and practices of wholesale markets handling fruits and vegetables and other perishables. In several cases this interest is resulting in the preparation of detailed plans for reorganization of markets more adequately to meet the needs of farmers and the public. As an outgrowth of Bureau studies new markets have been established or are being set up in Kansas City, Mobile, and Philadelphia.

The new market in Kansas City consists of more than 75 stores for wholesalers, each having direct rail connections for the placing of cars arriving over all railroads, about 400 sheds for farmers, a large cold-storage house, an auction building, and other facilities necessary to provide a thoroughly modern food terminal. This market is being built at a cost of more than $4,000,000, and will not only meet the present needs of the Kansas City area, but is so designed that space is available for future expansion when and if it is needed. The provision of this market will correct a number of existing evils in the wholesale handling of perishable products in Kansas City. It will result in saving several hundred thousand dollars annually, including $150,000 in cartage costs alone.

The new market in Mobile has been built in such a way as to provide an adequate space for serving the farmers of that part of Alabama. The new market facility in Philadelphia was established at practically no cost by inducing the Pennsylvania Railroad to open its excess facilities for the handling of motor-truck receipts, thereby creating a centralized wholesale market in Philadelphia handling both rail and motor-truck receipts. The willingness of the railroad to enter into this venture marks a departure from its previous policy of building markets for the exclusive use of produce arriving over its own lines. It is believed that if the markets in Philadelphia could be completely centralized there would be savings of some 1 or 2 million dollars annually in total costs of handling, including nearly half a million dollars' saving in cartage costs alone.

Progress has been made toward the development of a new market in Atlanta. Land has been bought, and the plan is to set up a public corporation that will build a complete unified market in an area large enough not only to take care of current business but to provide for future expansion. As soon as this corporation is set up, the whole program is to be pushed to rapid completion.

MARKET NEEDS IN THE SOUTHEAST

In cooperation with the agricultural colleges of four Southeastern States the Bureau has been studying the market needs in that area to decide where concentration markets should be established, how many there should be, how they should be equipped and operated. During the current year it is expected that the final report can be prepared making definite recommendations for establishing an adequate marketing system for fruits and vegetables in this area.

A study was undertaken to find out what is necessary to modernize the Richmond market. Much information has been assembled, contacts have been made with all of the interested persons and agencies, and a preliminary report describes the existing situation and indicates what improvements should be made in order to provide a market that will adequately serve the city of Richmond.

BETTER MARKET SERVICES

Market news is one of the most useful services the Government provides to agriculture. It keeps farmers and dealers informed concerning prices and market conditions throughout the country and thus encourages and promotes orderly marketing. That these services may be most useful, it is necessary to make detailed studies

of the accuracy and adequacy of the information obtained and published. These studies, during the year, dealt particularly with livestock, butter, and tobacco.

Rapid increase in the direct marketing of livestock in recent years has made it especially difficult to report useful information on shipments, movements to market, and receipts. Years ago such material reported by the railroads was reasonably satisfactory, but now a substantial proportion of livestock moves by motortruck. Ways to report this movement are being developed in cooperation with several State agencies.

Cooperative methods have been worked out to report the direct marketing of stocker and feeder cattle and sheep from range States to feed lots and pastures in the Corn Belt. Arrangements also have been made for the issuance of weekly reports by the Agricultural Marketing Service on marketings of livestock for slaughter. These reports cover 73 to 83 percent of the total slaughter for the country as a whole, and should be a good index of weekly and monthly changes in total slaughter.

For many years there have been controversies about the Chicago butter quotations which are used widely as a basis for buying and selling butter over a large part of the country. Farmers and others have complained that quotations do not accurately reflect the true butter market. The Bureau is cooperating with the Agricultural Marketing Service and with Northwestern University in a detailed study that will attempt to find improved methods of quoting the market. Much information has been gathered and some preliminary analyses have been made to include both a study of the accuracy of the price quotations and some study of the accuracy and usefulness of the butter grades and butter inspection which, of course, are closely related to the market-news problem.

Quoting of prices of tobacco is one of the most difficult of market-news problems. There appears to be considerable variation in prices of different lots of tobacco of approximately the same quality, sold in the same market, on the same day. The Bureau has obtained complete records of actual prices obtained by tobacco growers in a number of markets, and has analyzed this material in some detail as a preliminary to considering the policies that need to be followed to provide farmers with useful information on prices of tobacco. These studies have made possible some improvements in the tobacco market news material of the Agricultural Marketing Service.

MILK-MARKETING POLICIES

Municipal, State, and Federal Governments have been developing gradually a number of programs to regulate the marketing of milk and dairy products. These include regulations by local boards of health, by State milk boards and other State agencies, and the marketing agreements and orders of the Federal Government. Regulations cover a wide field, including the inspection of milk, the demarcation of milk sheds, the fixing of milk prices, and the regulation of pooling arrangements. The general objective of all such regulations should be to provide economical methods of marketing, to assure the consumers an adequate supply of safe milk, and in general to encour-

age desirable changes both in the production and in the distribution of milk and dairy products.

The Bureau is cooperating with the six agricultural experiment stations in New England in a series of studies dealing with problems of milk marketing. These are intended eventually to work out a marketing program including the country problems of assembling and shipping milk, the city problem of distribution, and the problem of assistance and regulation by public agencies.

Major emphasis during the year has been on the country end of marketing. Each of the six experiment stations made studies of local milksheds, including analyses to determine factors influencing the size and location of the supply areas for the principal markets in each State. Three of the States made detailed studies of the trucking of milk, including analyses of trucking rates, and of possible economies in reorganizing and relocating trucking routes. Several of the States are studying milk prices, with particular emphasis on detailed analyses of factors influencing the prices received by different groups of producers. Some detailed work has dealt with measuring the elasticity of the supply of milk in Vermont.

The principal contribution of the Bureau has been in studying the organization and location of milk plants and of the major milksheds in New England. The purpose is to discover changes that might be made in the number, sizes, kinds, and locations of milk plants and in the boundaries of milksheds for greater efficiency in the milk-marketing system. Detailed analyses of the cost of operation of typical milk plants, and of the costs of collecting milk from the surrounding farms and shipping to consuming markets are required. During the coming year the studies in New England will begin to emphasize more the problems of city distribution.

The Bureau's studies of markets in general have indicated many concrete ways of reducing distribution costs and improving methods of handling. But in all of the work thus far the Bureau has been handicapped in getting satisfactory improvements by the lack of some agency to take the initiative in putting into effect a definite program. It will probably require State and Federal legislation to bring about the construction and operation of new markets so that the possible savings may be effected and the public interests safeguarded.

The produce trade interested in these studies is cooperating as well as it can to make indicated improvements. But in most cases they are finding that they are not able by themselves to bring about such changes. It appears only a matter of time before this Department of the Federal Government will be called upon to formulate policies regarding legislative action on these problems.

MARKETING COSTS AND CHARGES

A most popular and useful line of fundamental research carried on during the last few years has been a study of marketing costs and charges. Work on price spreads between farmers and consumers for 58 food products was continued with the publication of an annual supplement to the existing report early in 1939, and the regular issue of monthly releases. Special studies are under way to provide more adequate price-margin comparisons for cotton goods and clothing and for wheat flour and bread.

The most striking feature of price spreads for all 58 foods treated as a single composite is their stability during the last 4 years. The remarkable agreement of annual changes in price spreads and hourly wage rates that had persisted for 14 years was interrupted in 1936–37 when wage rates made a sudden rise.

These statistical studies show also that the farmer gets less than half of each dollar the consumer spends for food. The total annual bill for processing, marketing, and distributing farm products amounts to more than the total income received by farmers.

It is not enough to gather and summarize data on total spread between prices at the farm and prices in city retail stores. These must be analyzed in some detail in order to get a clear picture of recent trends in marketing costs and charges, and to understand how marketing costs are affected by changes in marketing methods, changes in wage rates, and many other developments in the marketing processes and in the general economic system. It is necessary also to understand these marketing costs and charges in some detail in order to know which parts of the marketing system account for the greatest share of the cost. An intimate knowledge of these detailed facts is helpful as a guide to further and more detailed work on market organization for the purpose of studying possible improvements in the system which have promise of greater efficiency and lower costs.

Considerable attention is being given the problem of how the price-making forces operate, in order to have some assurance that the prices for farm products actually reflect the supply and demand conditions. During the last few years there has been a great deal of purchasing by large-scale organizations directly from producing areas with the prices based on market prices in the central markets for products that are moving through the regular channels. The effect of this on the price-making processes is an important consideration. Similarly, the prices in large city markets, the prices established on organized exchanges, and in other organized institutions and markets are often an important determining factor in the prices paid to farmers.

The Department of Agriculture has broad authority to study marketing methods and practices and to consider changes for the purpose of improving marketing policies for bettering the market system. To perform fruitful work in this field, it is necessary to carry on considerable fundamental research including the gathering, summarization, and analysis of large quantities of factual and statistical material describing marketing methods, costs, charges, trends, and conditions, and pricing mechanisms. The work of the Bureau is not limited to the compilation and summarization of such information but includes detailed analyses and interpretations leading to recommendations for possible changes in marketing methods and practices.

COTTON PRICES

Emphasis has been placed on studies of cotton prices. Information collected during the seasons 1928–32 showed conclusively that prices to growers in many local cotton markets reflected only a small proportion of central-market premiums and discounts for grade and staple length. Apparently, one of the reasons was the lack of ade-

quate information on the classification of cotton at the time it was sold.

Classification services have been made available to growers in a few markets and information has been collected to ascertain the influence of these services on prices to growers and on the quality of cotton produced. Studies indicate that grade and staple premiums and discounts to growers varied directly with the reliability and general acceptability of the classification on the basis of which the cotton was sold. Aside from premiums and discounts on an individual-bale basis, farmers who sold in local markets where the average quality was relatively high usually received correspondingly higher prices than those who sold in local markets where the average quality was relatively low; but the average level of prices was little, if any, higher in markets with a public classification service than in those without such a service.

These findings suggest that, unless the public classification service is associated with material changes in marketing methods and practices other than varying prices on the basis of quality, the possibilities of raising the price level in specific local markets by means of such a classification service are limited chiefly to the influence of improvements in quality brought about by the classification service.

Analysis of cotton prices in spot and futures markets shows, among other things, that the analysis of the supply-demand price relationships is handicapped by a lack of adequate measures, or indicators, of the market supplies of and the demand for cotton. But, despite the imperfections of these measures or indicators, it was shown that variations in the average annual price of Middling 7/8-inch spot cotton in the 10 designated markets are accounted for largely by changes in the purchasing power of the dollar as indicated by the Index of Wholesale Prices of All Commodities, by changes in the supply as indicated by world total of all cotton, and by changes in the demand for cotton as indicated by changes in the World Index of Industrial Production.

DISTRIBUTION AND ORGANIZATION

One of the important marketing developments of recent years is the growth of large-scale food distribution. Farmers are directly concerned with the effects of this development on the prices for their products, and hence with the public policy adopted toward large-scale food concerns. This Bureau has been engaged in a series of studies to show how farmers are affected by the growth of large food concerns and how they might best deal with some of the major problems. Studies include chain-store distribution of fruits and vegetables; dollar sales, capitalization and earnings of leading food and tobacco corporations; retail sales campaigns for farm products; large-scale organization in the dairy industry; and the patent situation in the food industries.

The Department has been authorized to make broad economic studies of the marketing system for the purpose of finding out how the system operates, what its weaknesses are, and what changes should be made to make it more efficient in serving the farmer and the public. The work on market organization includes studies of organization and structure of markets for farm products, the efficiency of existing

facilities for the processing, distribution, and sale of these products, the relative desirability and efficiency of the different marketing channels, the different types of business organizations and institutions in the field of marketing, and the development of new and extended uses for farm and food products.

NEW OUTLETS FOR FARM PRODUCTS

Studies are being made of economic possibilities of new markets for agricultural products. At present this work is limited to new markets for cotton. Three studies completed on the utilization of cotton and competing materials dealt with the use of cotton for fertilizer bags, cordage and twine, and hosiery.

Technical research deals with the developing of new products. During the year the Post Office Department agreed to make trials of cotton twine in tying bundles of letters. In the past jute twine has been used almost exclusively for this purpose. The Bureau cooperated with the Navy Department to develop parachute cords of cotton in place of the present cords now made of silk. This potential use of cotton is not large, but it is obviously important in case of war. Cooperation was maintained with a number of other agencies in the development of specifications for fabrics, including specifications used by the Agricultural Adjustment Administration in its cotton-diversion program, by the Agricultural Marketing Service for certain coverings for cotton bales and by the Bureau of Public Roads for soil-fixation in cuts and fills.

THE FARMER'S INTEREST IN FREIGHT RATES

To prevent further increases in freight rates on agricultural products, the Secretary and his representatives intervened in a number of cases before the Interstate Commerce Commission during the year. Cases in point involved attempts of the railroads to increase by amounts ranging up to 10 percent the transcontinental rail rates on fresh deciduous fruits and fresh vegetables; a current effort of the railroads to secure authorization from the Commission to increase the estimated weights on packages of citrus fruits and vegetables and fresh deciduous fruits and vegetables which, if secured, would have the effect of greatly increasing transportation charges to agricultural shippers; the plan of the railroads to increase indirectly by approximately 17½ percent the freight charges for transporting stocker and feeder livestock, by so changing the rules and regulations governing feeder rates as to greatly restrict the opportunities to use the 85-percent rates that have applied for many decades; and efforts to increase the rates on cotton, grain, and grain products, and express shipments of perishables.

The Secretary of Agriculture on January 18, 1938, appeared before the Interstate Commerce Commission in the fifteen-percent case, 1937–38, to take a position in opposition to a proposed horizontal increase of 15 percent in rail freight rates. He pointed out both the serious burden that would be imposed upon agriculture by such a large increase at a time when farm prices and income were declining and the inconsistency of the projected rate increase with the long-run

interests of both the railroads and farmers. The Secretary's testimony was effective in preventing an increase larger than the 5 percent authorized on farm products by the Commission in March 1938 which compares very favorably with the 10-percent increase authorized on most industrial commodities. Subsequently, the railroads have made a general attempt to raise rates on farm products which in recent years had fallen below maximum levels prescribed by the Interstate Commerce Commission before the depression of the early 1930's.

FREIGHT-RATE DIFFERENTIALS AND INDEXES

Preliminary survey of freight-rate differentials between territories was made during the year. Opponents of present rate adjustments maintain that if rates from points within a destination territory, usually the official territory, to a market, distance considered, are lower than rates from another territory to the same market the interterritorial shipments are burdened without just cause. Preliminary surveys indicate that the bulk of interregional competition among agricultural shippers centers in efforts of agricultural producers from the South, Southwest, and West to reach the populous markets of the East. Apparently much of the agitation with respect to the problem of these freight-rate differentials emanates from industrial sources interested in attracting industries to the South and West. Although agriculture's interest in this issue may not be so great as popularly urged, farmers might find the barrier of distance of less importance if industrial production with its attendant population were to increase in communities in the South and West closer to their farms. This might also provide an employment outlet for surplus farm population.

Substantial progress was made toward the completion of a series of indices of railroad freight rates on fruit and vegetable shipments in the United States. The plan is to develop national indices for principal individual commodities, for subgroups of commodities, and for fruits and vegetables as a whole. In prospect also are indices of railroad freight rates applying on commodities as classified above from their principal origins to various destinations important to the given producing areas. A further plan calls for indices of rates for as many of the commodity classes as possible applying on shipments from whatever origins in the United States to the largest individual markets, for example, on all fruits and vegetables shipped by rail to New York City from representative origins.

The extent to which these indices can be extended from the general to the particular will depend primarily upon the availability of freight rates applying on the given commodity classifications from and to the selected representative origins and destinations. The value of the indices will depend to a lesser degree upon the quality of the possible analyses of traffic quantities. It is not believed that the construction of indices of motortruck rates is possible with the data now available. Revisions of the currently published indices of railroad freight rates applying on shipments of wheat, cotton, and livestock, are planned. Although revision of the formulas from a mathematical standpoint is envisioned, the revision will be designed mainly to take account of the changed character of the traffic.

TRANSPORTATION RESEARCH

In an effort to clarify the economic problems relating to the transportation of farm products and to suggest specific policies and measures for their solution in the interest of both agriculture and the public, a program of economic research is now being planned and conducted.

Studies of ways and means to obtain more satisfactory railroad-rate adjustments on farm products are under way. An inquiry into the intent of the Congress in instituting regulation of motor-carrier rates by the Interstate Commerce Commission and an examination of the Commission's actions and policies with respect to motor rates to ascertain the economic effects of these policies upon agriculture form one important project. The program includes studies of freight-rate differentials that exist throughout the United States, the probable economic effects of applying a uniform mileage scale for a given commodity throughout the country, fluctuations in freight rates on farm products, and the factors contributing to these fluctuations. Alternative policies by means of which the efficiency of the transportation system as a whole could be improved through promotion and regulatory policy are being appraised.

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Report of the Chief

of the

Agricultural Marketing Service

1939

THIS is the first annual report of the Agricultural Marketing Service. The creation of the Service was announced in October 1938 by the Secretary of Agriculture as one of the major changes for unifying Department work in the interest of better serving the public in the agricultural marketing field. The Service was formally established at the close of the 1939 fiscal year following the passage of the Agricultural Appropriation Act for 1940.

The important role of the newly created Service is to help those engaged in agricultural and other pursuits by disseminating current production and market information and by regulating marketing practices. The various activities of the Service are designed to meet the everyday needs of farmers, distributors, and consumers.

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REPORT OF THE CHIEF OF THE AGRICULTURAL MARKETING SERVICE, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
AGRICULTURAL MARKETING SERVICE,
Washington, D. C., October 10, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith the report of the Agricultural Marketing Service for the fiscal year ended June 30, 1939.

Sincerely yours,

C. W. KITCHEN, *Chief.*

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AMPLE SUPPLIES OF FOOD AND FIBER

Ample supplies of food and fiber crops are reported again for the third successive year. Prospects for tobacco indicate the highest acre yields on record. Good yields were realized on a greatly reduced cotton acreage. Fruit and vegetable production was larger than expected early in the season. An excellent corn crop matured in the Corn Belt. Though the total acreage in feed grains was smaller in 1939 than average, the large stocks of corn and oats on farms indicate a feed-grain supply during the 1939–40 season from 5 to 10 percent above the supply per unit of livestock that was usual in years prior to the recent droughts.

The abundant harvests have brought a further increase in the size of livestock herds and poultry flocks the country over. A production of about 83 million pigs is indicated for 1939, the third largest

crop since 1923. Estimates showed an unusually large lamb crop, a rather large increase in numbers of cattle on feed, and a 22-percent increase over 1938 in turkey production.

But large crops bring attendant marketing problems. When supplies of a commodity are unusually large, distributors and consumers are more discriminating in their purchases. The best quality sells first. This fact has been reflected the past year in the increased demands for information regarding the quality of farm products. Furthermore, with intensive competition among producing areas, current crop and market reports on prices, volume, and time of movement have been eagerly awaited by growers and shippers. From areas of the Northeast and West, where production was severely curtailed this year by drought, an unusually heavy demand has come for more information as to sources of supplies and as to price relationships between markets in nearby regions.

INCREASED DEMAND FOR INFORMATION

Every year, however, whether crops are large or small there is need for such information. Complex problems of modern-day agriculture fall heavily in the field of marketing and distribution. The farmers' market is no longer defined by the arbitrary lines of community or State. The domestic market is Nation-wide. Commercialized agriculture of today is inherently dependent upon the availability of fundamental economic data—upon facts of supplies available and supplies to come—that must be promptly and widely disseminated. Many crops are highly perishable, and a few days' delay in catching the trend of the market may mean the difference between reasonable profit and ruinous loss. Basic data are essential to the intelligent appraisal of supply and demand factors, and to the formulation of production and marketing plans and programs of private as well as Federal and State agencies. This has been particularly evidenced during the last few years.

PROGRAM TO REACH CONSUMER

The Department also is becoming more cognizant of the fact that a well-rounded agricultural program must be extended to the consumer. If farmers are going to sell, consumers must be able to buy. More attention than ever before is now being given to the methods by which the margin between what the grower receives and what the consumer pays may be lessened. Studies reveal that less than 50 cents of the dollar that consumers spend for food products reaches the producer. With some fruits and vegetables, less than a third of what the consumer pays goes back to the grower. Unnecessary handling charges and outmoded marketing facilities take a big toll of the estimated 1½-billion-dollar bill for marketing fruits and vegetables alone. Greater effort is therefore being devoted to more efficient methods of grading, packing, packaging, and shipping, by which waste may be lessened, quality of products reaching consumers improved, and costs of marketing reduced.

During the past year, the role of the Agricultural Marketing Service in helping to bring about efficient—and fair—marketing has been centered in five broad fields of service: (1) The gathering and

disseminating of crop and livestock production statistics have indicated supplies available and supplies in prospect throughout the growing season. (2) The daily reporting of prices, volume, and quality of movement has provided a day-to-day picture of supply and demand conditions at terminal markets, shipping points, and producing sections for more than 100 agricultural commodities. (3) Standardization and inspection services have provided a common language in merchandising and have facilitated the marketing process. (4) Standards of quality, and marketing practices for a number of farm products, have been improved as a result of research. (5) The supervision of rules of fair play, as specified in 17 specific laws administered by the Service, has been directed toward the maintenance of merchandising ethics in the various channels of trade.

NEW TECHNIQUES AND SERVICES

Several new developments in these fields during the past year were of outstanding importance. New techniques in crop estimating brought definite promise of increasing the accuracy of crop-yield estimates. The preharvest wheat survey, started this year, gives a valuable indication as to the quality of the new crop before it leaves the hands of producers. New formulas for considering the effects of weather, soil moisture, and other factors which may be expected to affect crop yields are being perfected.

The market news service was expanded somewhat, especially in the South, in order to fulfill increasing demands of producers. The 7,500 miles of leased telegraph wires that reach out to major terminal markets and important producing centers, nearly half of all radio stations in the United States, the press, and the thousands of mimeographed reports issued, kept farmers and the general public informed of the daily changes and longer-time trends in the markets.

PROGRESS IN STANDARDS AND GRADING

New standards, of importance both to producers and consumers, were put into effect. In defining the grades recently adopted for carcass beef a terminology more easily understood by consumers is used. A revival in the production of sea-island cotton has necessitated the adoption of 11 new grades for this type. Revised standards of quality for creamery butter were put into effect during the year, and preliminary conferences were concluded on the proposed revision of the standards and grades for shell eggs.

Inspection, grading, and classification are being more widely used each year. The tonnage of meat graded during the year increased 10 percent over that of the previous year. One particularly significant development of the past year was the decision of the Supreme Court upholding the constitutionality of the Tobacco Inspection Act. This decision clears away the last legal obstacle to the development of the tobacco-inspection service, which enables the grower to get the price to which the quality of his crop and the condition of the market entitle him. The quantity of butter and cheese graded increased substantially over that of the previous year.

That standardization and inspection are becoming more widely used is partly attributed to the educational and demonstrational programs

conducted in cooperation with State extension services, State departments of agriculture, agricultural colleges, and other agencies. At meetings, attended by thousands of farmers, dealers, and consumers, it was shown how standardization and inspection, while increasing returns to producers, give the consumer a better-quality product for the price paid. Grain-grading demonstrations alone were attended by more than 10,000 producers, shippers, and dealers. Over 53,000 persons were shown better methods of preparing tobacco for market.

Increased emphasis is being placed on marketing research and techniques in grading. Laboratories are maintained in Washington and in the field to improve cotton standards, and to develop better quality in raw and manufactured cotton. Some 20,000 physical and chemical tests were made to provide a background for making changes in the grain standards, and for improving inspection techniques. Cooperative research in meat quality continues, and involves the comparison of records pertaining to measurements of cooking and palatability with the standard grades. Comprehensive tests relating to wool shrinkage are under way.

LEGISLATION AND COOPERATION

Various acts of Congress, intended to regulate the relations of producers and distributors, were administered during the year. In supervising the business conduct of the stockyards and meat-packing industries, a number of cases of unfair and deceptive practices were discovered and corrected. Approximately 20,000 commission merchants, dealers, and brokers operated with licenses issued under the Perishable Agricultural Commodities Act—an increase of 176 over the previous year. A high-water mark was set in the volume of commodities that could be stored in federally licensed warehouses.

Legislation was enacted to broaden the control of imported seed by requiring that all imported agricultural and vegetable seeds meet certain standards and that importations of screenings and seed containing noxious weed seeds be restricted. Under the new Federal Seed Act, which becomes effective in 1940, farmers will find it possible to obtain higher-quality seed because of the new requirement that seed moving in interstate commerce shall be labeled to show purity, germination, and other factors.

The consolidation of all marketing work of the Department of Agriculture into four closely integrated agencies was of major interest to agricultural groups the country over. The Departmental reorganization of October 1938 set up as one of these agencies the Agricultural Marketing Service, which was formally established following the passage of the Agricultural Appropriation Act for 1940. The new bureau brings together various activities of the Department in the marketing service and regulatory field.

To give the most complete and thorough service, much of the work of the Agricultural Marketing Service is handled through cooperative agreements with State departments of agriculture and State agricultural colleges. Some 250 of these agreements were in effect during the year.

AGRICULTURAL STATISTICS

The program of statistical reports and services rounded out a full century of official governmental collection of primary statistics relat-

ing to agriculture. The beginning, in 1839, when Congress appropriated $1,000 to the Patent Office "to distribute seeds and to collect agricultural statistics," bears only the faintest resemblance to the widely diversified list of statistical reports now furnished the agricultural interests and the general public.

Tremendous changes have occurred in this century in the scope of the Nation's agriculture, and in the character and magnitude of the agricultural practices employed. In 1839, agricultural products were produced largely near consuming markets. Today, they may be produced in areas thousands of miles distant. The rapid growth of transportation has increased the competition between producing areas, and between products. The increasing distance between producers and consumers led to the rise of middlemen, which development, in turn, created new marketing problems.

These ever-increasing complexities of modern-day agriculture have resulted in a greater interest in basic facts. Such data are called for in great detail to provide a basis for sound judgment in the production and marketing of agricultural products. Millions of dollars worth of agricultural commodities were sold last year on the basis of official estimates of crop and livestock production. These reports furnished an almost continuous digest of the changing situation with respect to actual or prospective supplies of farm products.

CURRENT ESTIMATES ISSUED

Current statistics were published for all the major crops and other products of the farm. Included in the list were about 105 different crops, 6 major livestock species, poultry and eggs, milk, wool, and other livestock products. Periodic reports were issued on wages and employment of farm labor, on prices received by farmers for their products, and on prices paid by them for articles they buy. A rather comprehensive series of periodic reports was made available regarding the transportation, processing, storage, and other forms of premarket handling of farm commodities in the various stages through which they pass between the farmer and the consumer.

These facts, of course, were extremely valuable to those interested in agriculture, including farmers, governmental agencies, and colleges. But they were also used by commercial concerns, banks and other credit agencies, railroads, advertising firms, and State and Federal legislative bodies. The reports served an increasing number of needs in economic research, in planning and administering program operations, in analyzing future prospects, in the development of agricultural and business enterprises, and in assisting legislators to formulate agricultural laws.

The growing use of statistical information currently published has been accompanied by a demonstrated need for additional forms of detailed data, covering certain specialized aspects of agricultural production. Information has been requested on crops by varieties, on various forms of utilization, on farm and commercial stocks, and on other significant indications regarding the production, sale, movement, and price of the various crops. It was not always possible to furnish the information requested.

Numerous requests for district and county data were received. Such reports were published for varying lists of crops and other products in 20 States where a State agency cooperates in the crop-reporting service.

Other county data were issued as a byproduct of work done for the Agricultural Adjustment Administration and the Federal Crop Insurance Corporation. The publication of complete county estimates is a long-time program that will be put into effect as soon as facilities permit.

THOUSANDS OF VOLUNTARY REPORTERS

Approximately 2,400 different forms of inquiry and over 10,000,000 copies of such forms were sent out last year to obtain necessary information on which to base the official reports. More than 200,000 farmers reported voluntarily in 1 or more of the surveys. Various lists of reporting establishments, such as cold-storage warehouses, canners, packers, mills and elevators, and other plants and factories probably accounted for 30,000 or more responses.

Most of the 10 million schedules or questionnaires were mailed out by the field offices, and the returns were tabulated and summarized by them. Each of the 40 field offices had in charge a trained statistician with 2 or more technical assistants and clerks. The summaries were sent to Washington where they were reviewed by the Crop Reporting Board (usually 7 Washington and field statisticians designated by the Secretary of Agriculture) and then assembled and issued for the United States. Regular monthly reports covering forecasts and estimates were approved by the Secretary of Agriculture before issuance.

The crop-and-livestock reporting service was conducted under formal cooperative agreement with 30 State agencies as a joint Federal-State undertaking. In 22 of the States the cooperation was with the State department, or board of agriculture, or some other State commission or agency. In 8 States the cooperation was with either the State college of agriculture or the agricultural experiment station. A cooperative agreement was effected with the State of Louisiana, April 1, 1939.

Formal cooperation in the collection and tabulation of reports from dairy manufacturing plants was arranged with 9 States, making a total of 20 States with which such agreements are in effect.

DEMANDS FOR SPECIAL SERVICES

Special statistical services of a type similar to those of the previous few years were again performed for the Agricultural Adjustment Administration. The requested data were used in making determinations relating to marketing agreements and the agricultural-conservation programs. Acreage, yield, and production estimates, by counties, were furnished for cotton, corn, wheat, rice, and peanuts; and similar estimates, by crop-reporting districts, were made for tobacco. Estimated numbers of milk cows and of all cattle, by counties, were furnished.

Extensive series of special production estimates and of services for crops subject to control under marketing agreements were required. Varietal segregations were made for various fruit and vegetable crops, bearing and nonbearing acreage of California fruits, early-season forecasts of production for a few crops, estimated acreage of vegetables grown for sale, estimated vegetable supplies remaining for disposal, and special series of on-tree fruit and in-field vegetable prices.

A special study was undertaken in December to determine the normal acreages of soil-conserving crops and practices, by States.

The crops and practices selected corresponded as closely as possible to those included in the agricultural-conservation and the range programs of the Agricultural Adjustment Administration. Examples of the items upon which reports were made are: New seedings of legume and perennial grasses; green manure and cover crops; fertilizer and lime applications; fallow acreage; acreage terraced, tilled, and cropped to protect cropland and pasture land from wind and water erosion; and range land improved by reseeding, controlled grazing, ridging, and furrowing.

Several estimating projects were also undertaken in connection with the new Federal crop-insurance program. Funds were provided for the preparation of estimates of acreage and yield (per planted acre) of corn and wheat, by districts and counties, for a limited number of States, and similar data for cotton in Texas and Oklahoma. Much of the previously available county information was completely reworked in order to adapt the estimates to the bases required for insurance purposes; in some instances the series of county estimates were entirely new.

Considerable assistance was given the Bureau of the Census in making plans for the 1940 census. Inquiries on crops, on livestock, and on general economic subjects, were reexamined. A great deal of work was done in preparing the instructions to enumerators. The Bureau of the Census also gave favorable consideration to the restatement of the inquiries for some of the crops for which information has been difficult to obtain in past years because of complications in utilization. The questions on legumes, for example, have been changed to a form which offers considerable promise of obtaining a reasonably accurate enumeration.

NEW DEVELOPMENTS IN CROP FORECASTING

New methods of improving the accuracy of the reports were inaugurated. In the Great Plains States soil-moisture tests were continued, particularly in Nebraska and Kansas. Representative fields over a wide territory are tested in the fall and spring by means of soil tubes. Subsoil moisture has been found closely correlated with yields in much of the Great Plains territory.

Cotton-boll counts, started a few years ago, also were continued. Fifteen-foot strips in representative fields are measured and counts are made of the number of plants, mature bolls, immature bolls, squares, and blooms, as well as the number of squares and bolls punctured by the weevil. Two counts are made each year, one in August and one in September. The average size of sample lots of bolls is also measured by means of boll meters by which the volume of the bolls can be determined. Similar tests are being made with corn, the plants and ears being counted on a measured distance in representative fields. The length and size of ears selected at random are also measured. It is still too early to determine whether information collected can be used in current forecasting but the results so far are promising.

The latest innovation in Government crop reporting is the preharvest wheat survey, started this summer, in the winter and spring wheat areas of the Great Plains region. In conducting the survey, three field crews started on June 1 in southwestern Oklahoma. These

crews worked northward, just ahead of the harvest. Laying out their routes to form gridlike patterns across each county, the crews obtained head samples from an area approximately one five-thousandth of an acre some 2 to 5 days ahead of harvest. Measurements included drill widths and heights of the wheat plants in the units from which the samples were taken. In laboratories at the Kansas and the North Dakota Agricultural Colleges, chemical and other determinations were made and the test weight, protein content, and variety were ascertained. In addition to supplying information on quality before the wheat leaves producer hands, it is hoped that the measurements of yields per acre will be helpful in estimating yields and production.

Other studies, dealing with basic analyses of sampling problems and techniques, crop yield-weather relationships, long-range weather and crop forecasting, and general research in statistical methods and theory as applied to the field of crop and livestock estimates have been started. Several of these projects are being conducted with Bankhead-Jones research funds, made available for undertaking cooperative studies in collaboration with State colleges and agricultural experiment stations.

MARKET NEWS

Complementary to the Nation-wide crop- and livestock-reporting system, are the day-to-day reports on supply, demand, and price conditions at primary and terminal markets. Such information on some commodities has been made available each market day for nearly 25 years.

The historical development of the market news service traces back at least as far as the turn of the present century, which is generally recognized as the time when scientific study of marketing problems really began. The demands for such a service were essentially those that resulted in the establishment of the Office of Markets in the Department in 1913. Farmers and farm leaders during this period were wondering whether the prices quoted were going prices or whether bids were being artificially scaled, and whether markets were being manipulated to produce gluts and low prices. Also, quotations at various markets were not comparable. The response to numerous complaints was reflected in various marketing conferences and in investigations started by organized farmer groups and by the Federal and State governments.

The first marketing study within the Department of Agriculture was made on cotton, but the first market news service began on fruits and vegetables in 1915. The first report, covering strawberries, tomatoes, peaches, and cantaloups, was issued in March, and branch offices were established at 6 major markets during the year. The work expanded rapidly. During the past year, fruit and vegetable offices were located at 22 markets in the leading consuming centers and at 46 field stations, temporarily maintained from 1 to 8 months during the heavy marketing season. Shipment reports covering 47 different commodities were compiled and issued daily.

The report of arrivals and cars on tracks of 22 or more fruits and vegetables in 16 large cities, and reports on cars passing through the leading gateways, were regarded as especially valuable by thousands of shippers and dealers. The honey and peanut market reports were further expanded by additional news from producing sections.

Commodity-market information is now being disseminated daily on more than 100 crop and livestock products. Because of its established regularity, the service, although admittedly indispensable in the American system of marketing, is now usually taken for granted.

The value of market news is dependent on the importance and volume of facts obtained, the clarity with which the information is portrayed, and the promptness and breadth of its dissemination. Comments received indicate that more progress was made the past year in improving the interpretation and appearance of the reports, and in enhancing their accuracy, than in any preceding period of the service.

Coincident with the decided increase in number of farm homes having radios, the number of radio stations carrying market news has nearly doubled in the last 2 years. A survey of 726 stations operating the past year revealed that 345 stations broadcast daily market information, practically all of which originated in the commodity market news offices of the Agricultural Marketing Service. Some of the stations provide 3 to 5 scheduled broadcasts daily in order that producers and dealers in the territory they serve may be kept fully informed on changes and trends in the market.

To distribute the information in time to be of practical use, more than 7,500 miles (air line) of leased telegraph wires were maintained. This made possible the sending of material promptly from one market to another. Much of the information is sent by code, for the purpose of increasing the speed of transmission and of reducing wire costs.

Extensive distribution is made from each market news field office by telephone, press, and mail, and by posting on bulletin boards. For livestock and meat products alone, the number of copies of market reports mimeographed and distributed from the field offices approximated 7,850,000. This was a substantial increase over the preceding year, despite all effort to effect the widest possible distribution through facilities of commercial news-distributing agencies rather than through expansion of mailing lists.

Such blanketing of the entire country with market information has decreased the disadvantage of the individual producer and the small shipper who are in competition with the stronger commercial organizations better capable of obtaining information for themselves through far-flung trade connections. It helps to promote orderly marketing. It facilitates commodity distribution, discourages the dissemination of fictitious and misleading market information, and aids economic research looking toward improved marketing methods. The recording of the day-to-day happenings in permanent form provides a continuous story for use by marketing specialists and economists in making studies and analyses of production, demand, prices, and distribution.

THREE LIVESTOCK OFFICES OPENED

Under Congressional authority, new livestock market reporting offices were opened at Thomasville, Ga., Montgomery, Ala., and Houston, Tex., thereby increasing the number of livestock field offices to 32, including 1 temporary office operated for a 4-month period. These offices covered the activities of 29 public centralized stockyards and, to a more limited extent, "direct" and livestock auction markets in

parts of 14 States, 5 wholesale meat markets, and 1 wool market center. The opening of the 3 southern offices recognizes the long-felt and expanding need for placing this region in direct and timely contact with the Nation's leading livestock, meat, and wool market centers.

On January 1 plans were adopted and placed in operation which, for the first time in public market history, made possible the compilation and release of daily estimated and actual receipt data at the various public markets on a uniform basis. The value of such statistical data was materially enhanced by providing for their release based on salable and total unloads, and by trade agreements providing for a uniform 24-hour period in which receipts for a given market day are counted. The action taken was approved by representatives of all major and a large percentage of the minor stockyard markets of the country. Uniformity in the release of receipt data was further effected by the inauguration of a plan providing for the centralization of information in a way that makes it possible for the various offices to release, at practically the same time, the statistical data pertaining to 12 of the major livestock market centers. Each office also releases similar data relative to its own market.

With the cooperation of the Bureau of Animal Industry, arrangements were made which, effective the first week of the fiscal year 1940, permit the weekly release of reports disclosing the slaughter of livestock by species under Federal meat inspection at 27 selected centers on a weekly basis. The data embrace approximately 73 to 83 percent of the total inspected slaughter by species. This service is supplied in addition to the monthly slaughter reports previously released. The weekly release of these slaughter data answers a long-felt need for timely information of this character.

WIDE COTTON COVERAGE BY RADIO

New developments in the cotton market news work were in the main pointed toward getting more usable information into the hands of cotton farmers. The radio was used to a greater extent than during any other year in the history of cotton and cottonseed market news. For the first time a current up-to-the-minute price and market service was made available for use in selected local markets; regional reviews were prepared in field offices; official price quotations were compiled and published for cotton produced under irrigation; 10-market average prices were collected for $1\frac{1}{32}$- and $1\frac{1}{16}$-inch staples.

At Memphis and Atlanta, the cotton market news work and that relating to cottonseed were combined with the work on cotton quality statistics and classing, and at Dallas the cotton quality statistics and classing work and that on cotton market news were combined. It is believed that these consolidations will result in better coordination and greater efficiency.

CHANGES IN EGG MARKET INFORMATION

A new type of egg market information is being developed in Virginia in cooperation with the Virginia Division of Markets. The service provides for a daily report of prices paid producers for eggs sold on a graded basis to local egg-grading stations, of which there are approximately 40 in various parts of the State. Federal-State

graders grade each producer's deliveries according to Government standards, and the eggs are paid for according to quality. Prices are reported by each station and are summarized for release in a form that shows prices by grades in each of 6 different geographic areas. This information, along with prices paid for the same grades at Washington, D. C., the main market outlet for such eggs, gives a much more complete picture than has heretofore been available to producers and assemblers who are interested in developing quality programs.

Reporting of live-poultry prices was inaugurated at Seattle, following repeated requests for such service. The prices reported are on the basis of prices paid f. o. b. Seattle. The Seattle office brings to 12 the number of markets from which dairy and poultry market information is issued. Other cities also are important outlets, but the changes that occur in the 12 markets are reflected in similar changes at other points.

TOBACCO MARKET NEWS EXPANDED

The tobacco market news service was expanded to keep pace with the increase in number of markets where tobacco is being inspected for quality prior to sale. Semiweekly price reports were inaugurated at two points in southern Maryland where the first auction markets in the history of the State were established the past season.

STANDARDS FOR FARM PRODUCTS

Much has been said and many pages have been written about the standardization and inspection work of the Department. Previous reports of the Bureau of Agricultural Economics, the agency that formerly conducted these activities, have given detailed accounts of the services performed. Each year these activities have expanded at the insistence of producers, shippers, handlers, processors, and consumers.

Standardization sprang originally from a desire on the part of farmers and the trade for a quality guide to serve as a basis for buying and selling. Various commodity standards were set up, but uniformity within commodities and between markets was utterly lacking. Confusion, disputes, and needless losses resulted. This was before the formulation of Federal standards 25 years ago.

The demands for Government standardization and for Federal certification as to quality and condition reached their height at the outbreak of war in 1914. To expressed needs for orderly marketing, ethics in the market place, and uniform price quotations as between markets, were added demands for the elimination of waste in marketing and broader sources of credit for warehousing farm products. These demands culminated in the passage of the United States Cotton Futures Act in 1914 which required the use of Federal standards in futures trading, in the Grain Standards Act of 1916 which authorized the Secretary of Agriculture to establish official standards for grain, and in the United States Warehouse Act of the same year requiring that grades be stated on Federal warehouse receipts.

Through these statutes and others that followed, together with the authority carried annually in the appropriation act for the Department of Agriculture, official standards have been adopted for nearly

all of the principal farm products—for cotton, wheat, corn, and the feed grains; for tobacco, wool, and hay; for livestock, meats, butter, eggs, dressed poultry; for 57 of the fruits and vegetables; and for many other commodities.

UNIVERSAL COTTON STANDARDS

The official standards for American upland cotton are now in use throughout the world. The Universal Cotton Standards Conference of 1939, which convened in Washington in March, was the seventh such meeting under the universal cotton standards agreements. These meetings, attended by representatives of all of the leading cotton exchanges of Europe and Japan, are now held every 3 years to approve copies of the standards. The United States cotton standards, like those for grain, are mandatory if the product is sold by grade and shipped in interstate or foreign commerce. In most instances, the use of all other commodity standards is permissive, that is, they are used voluntarily as guides for merchandising on a quality basis.

The standards for sea-island cotton, as promulgated in 1918, were discontinued in 1925 because of the virtual disappearance of sea-island cotton from the American crop. In view, however, of the revival of the production of this cotton in Florida, Georgia, and Alabama, requests have been received in recent years for the reestablishment of sea-island standards. Proposed standards were prepared in the summer of 1938, and on July 30 of that year representatives of growers', merchants', and manufacturers' organizations met with Department representatives and approved the grade boxes and the cotton selected for the preparation of staple-length types. On August 10, 1938, the Secretary of Agriculture officially promulgated grade standards for six full grades and five half grades of sea-island cotton, to become officially effective on August 10, 1939.

Facilities of the Board of Supervising Cotton Examiners at Memphis and of other cotton-classing personnel were taxed to an extraordinary degree during the summer and fall of 1938. The announcement of the 1938 loan program, as issued August 27 by the Commodity Credit Corporation, included a provision that federally licensed cotton classifiers' certificates might be used as evidence of the quality of cotton for loan purposes. Thereupon a tremendous increase occurred in the number of applications for licenses under the United States Cotton Standards Act. A total of 2,248 licenses was issued compared with only 464 in the preceding fiscal year. Naturally, facilities were inadequate satisfactorily to cope with the supervision of the work of so many licensees, and difficult classing problems arose. Licenses of 172 licensed classifiers were suspended for cause. It is believed, however, that the corrective measures taken reduced materially the amount of overclassing of loan cotton and that the job as a whole was done as accurately as could be reasonably anticipated. Holders of licenses under the Cotton Standards Act reported the classification of 10,597,943 bales during the year, of which more than 4,000,000 bales were loan cotton.

A survey of the use of the linters standards in the cottonseed-crushing industry revealed that more than one-fourth of the mills that replied to the questionnaire, and that produced one-third of the linters crop, used the standards for control of quality of linters.

Opinion of the Board of Cotton Linters Examiners was requested on 62 samples of mattresses—representing purchases of approximately 2,000,000 mattresses—submitted by various branches of the Federal and State Governments.

REVISED STANDARDS FOR CREAMERY BUTTER

Official standards must be kept uniform. They cannot vary from season to season to conform to the quality of the crop. On the other hand, the standardization program must be kept sufficiently flexible to meet long-time changes in the nature of the product and in market requirements. Consequently, revisions in the standards are made following painstaking research and review as to the practicability of the changes.

Effective April 1, 1939, revised United States standards of quality for creamery butter were made official. The new standards provide a more exact and simplified system of determining the score of butter than the tentative standards which were displaced. The range of score was narrowed from the old basis of 75 to 95 points to a new basis of 85 to 93 points. The score-card method of grading was abandoned. A simple, definite, and more direct method of rating each factor—flavor, body, color, and salt—was substituted. Flavor is the most important factor of butter quality; factors of workmanship are secondary. The new grades definitely identify and evaluate some 30 flavors with a score rating for each, and each of these flavors is readily distinguishable in butter grading.

The official butter grades represent the experience gained by official butter graders during the last 20 years in developing a method of grading that will produce consistent and uniform results. The standards were tested for several months in actual grading work. Promulgation of the grades by the Secretary of Agriculture followed numerous conferences in various parts of the country with producers, distributors, and consumers. Under a provision in the Commodity Exchange Act, the new official grades for creamery butter are required to be used as the basis for trading in future contracts.

Preliminary conferences also were held on the proposed revision of the United States standards and grades for shell eggs.

REVISED BEEF STANDARDS

Coincident with the increased attention paid to the consumer's part in agricultural programs have come more and more requests for standards that carry through to the consumer and for simplified grade nomenclature.

In line with these requests and the increasingly larger interest being shown in buying meats by grade, a unified system of grades for carcass beef was developed during the year.

For several years a number of wholesalers have graded beef in accordance with a grading system known as the Institute standards. Though these standards were based on the same characteristics as the official United States standards for grades of beef, they provided for 10 grades as compared with the 7 in the official grade standards. Cattle producers, retailers, and consumers have urged that these 2 grading systems be coordinated as a means of increasing the quantity of meat graded in accordance with the official United States standards.

A number of conferences were held with representatives of the beef industry, as a result of which essential revisions in the standards for grades of carcass beef were agreed upon. Tentative proposed standards were then prepared and submitted to all branches of the livestock and meat trade for criticism and suggestions. The constructive suggestions received were incorporated in the proposed tentative standards to the extent that was considered practical. Official promulgation followed.

The new beef standards are intended primarily to facilitate the identification of beef by grade on the part of consumers. Approximately 545 million pounds of beef were graded and stamped under the old standards during the year—an increase of nearly 10 percent over the previous year. But consumers repeatedly have pointed out that the old system was too complicated. Though they could remember where the grade U. S. Good came in the grading scale, they found it difficult to learn and remember the quality differences between the U. S. Good steer, U. S. Good heifer, U. S. Good cow, etc. The new system provides for the grading of beef produced from steers, heifers, and cows in accordance with a single grade standard. In order for consumers to select beef on the basis of grade, they now need only to familiarize themselves with the grade names and their relative position in the quality scale, as the beef placed within each grade and bearing the same grade name will be essentially similar from a consumer standpoint.

North Carolina and Virginia hog producers have for a number of years sold a relatively large percentage of their hogs subject to carcass examination for degree of hardness after the carcasses have been chilled. It has been a customary practice for packers to withhold a part of the purchase price until the hogs are slaughtered and the carcasses chilled, and after examination of the carcasses to deduct varying amounts for those found to be soft and oily after chilling. In order to obtain uniform grading at all plants and to be assured of consistency in grading, the North Carolina and Virginia producers requested that the Department establish standards and conduct a grading service for hog carcasses with respect to degree of hardness. Sufficient research work was done in the different plants in which the hogs were graded commercially to determine that the standards employed by the Bureau of Animal Industry in their soft-pork investigational work constituted as equitable a standard as could be devised for the grading of hog carcasses for degree of hardness. Commercial buying interests were then familiarized with the standards and official graders were instructed in the grading of hog carcasses for degree of hardness. The work was carefully supervised to insure uniformity and adherence to the standards.

REVISED STANDARDS FOR WOOL TOP

Revised standards for wool top, by which the grades from 80's to 50's were placed on a measurement basis in accordance with the determination by scientific means, of the fineness, were promulgated March 11, 1939. Revised regulations were simultaneously promulgated pertaining to the distribution of practical forms and defining the methods of determination of the grade of top, in accordance with the standard specifications.

The setting up of standards for grades for top, based on diameter-of-fiber measurements determined with the aid of the microscope, marks a definite departure from traditional methods of grade determination. It is conceivable that the specifications, after a period of trial, may need further revision. The official standards encompass the grades from 80's at the fine end of the grade scale to 36's at the coarse, but the specification standards relate only to the grades from 80's to 50's. Additional research now in progress relates to the lower grades.

FRUIT, VEGETABLE STANDARDS WIDELY USED

A total of 82 standards has been developed for 57 different fresh fruits and vegetables. Two or more standards are necessary for some products because of differences in types and uses in various producing areas. The practice of grading produce to meet the requirements of these various standards has prevented much loss from waste and deterioration in transit through the elimination of culls and defective specimens before shipment. The educational value of the standarization program is evidenced by increased efforts to reduce losses through careless harvesting, hauling, packing, and other handling practices. A large percentage of the cars and truckloads of fruits and vegetables not actually inspected by official inspectors is packed to meet the requirements of United States standards and sold on the basis of such standards. Use of the standards as a basis of contract between buyers and sellers last year again played an important part in settling disputes under the provisions of the Perishable Agricultural Commodities Act.

During the year the control of shipments below a specified quality and proration of shipments in connection with marketing agreement programs were made largely on the basis of United States standards Virtually all purchases of surplus fresh fruits and vegetables under the Federal Surplus Commodities Corporation program also are made on the basis of these standards. Recent Canadian legislation requires that most of the fruits and vegetables imported from this country meet the minimum requirements of our standards.

Three grades—A, B, and C—have been developed for each of 26 canned fruits and vegetables. Though this work was started only about 8 years ago, the use of the official grade designations on individual labels is making rapid strides. At the same time that some canners and distributors are resisting the acceptance of this system of indicating quality on consumer merchandise, it is apparent that more and more consumers are refusing to pay a first-grade price for a third-grade product—as is often the case when the grade information is not available to them.

A development in the fruit and vegetable industry is frozen-pack production. In recent months tentative grade standards have been announced for frozen peas and frozen lima beans. There is little question but that definite standards for frozen foods will facilitate financing, adequate warehousing, and other phases of trading in these commodities. In addition, it is believed that this work will further extend the benefits of grade buying to consumers.

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CONTAINERS STANDARDIZED

Federal standards are now in force for barrels and for several types of baskets and hampers that are used in packaging fruits and vegetables. Last year, containers subject to the two Federal Standard Container (basket) Acts were manufactured by 360 factories in 33 States.

Tests and examinations were made of 1,054 items at 287 factories. Only 183 items failed, in some way, to comply with the legal requirements. At the close of the year, correction had been definitely accomplished in about a third of these cases, and the manufacture of 6 items had been discontinued. Other corrections will be effected when plants resume operations.

Consumers may be directly or indirectly defrauded by the sale of commodities in short-measure containers at the full-measure price. Consumers pay a part of the increased cost of marketing owing to the greater expense of manufacturing a large number of styles and types of fruit and vegetable packages. They also pay for the loss and damage occasioned by weak containers, improper stowage, or the difficulty of loading odd-sized packages.

Most fruits and vegetables are packed in crates, boxes, cartons, sacks, and drums for which there are no Federal standards. This fact is emphasized in Farmers' Bulletin 1821, Containers for Fruits and Vegetables, which gives a digest of Federal laws pertaining to fruit and vegetable packages and a review of the containers used in major shipping areas.

INSPECTION AND GRADING

Perhaps the most concrete evidence of the usefulness of the Federal standards is found in the records of inspection and certification.

Inspection and grading provide the action arm of the standardization program. In evaluating a product to the grower, to the processor and distributor, and to the consumer, the standards must be uniform on a Nation-wide scale—that is, from region to region, and from market to market. In reality, however, they are uniform only to the extent that they are interpreted accurately and applied consistently. This necessitates centralized training and supervision of the inspectors who apply the standards.

INSPECTIONS SHOW INCREASE

FRUITS AND VEGETABLES

In the 1919 fiscal year—the first full year of market inspection of these commodities—approximately 14,500 cars were inspected. Consistent annual increases have been noted, particularly since the inauguration of shipping-point inspection in 1923. During the past year 456,394 cars of fresh fruits and vegetables were inspected at shipping points and 48,865 cars were inspected at receiving markets. This was an increase of 6,329 cars at shipping points and a decrease of 187 cars at receiving markets. With the increase in direct movement by truck and a correspondingly better inspection coverage at shipping points, a slight decline in receiving-market inspections has been noted in recent years.

Marked decreases occurred in the volumes of inspections in States in which the late-potato marketing agreement was not effective during the year, but these were more than equaled by increases in the citrus-producing States which harvested the largest crop on record. Total inspections of fresh fruits and vegetables at shipping points and receiving markets for 1939, with comparisons, are shown in table 1. There were also 653,215 tons of fresh fruits and vegetables, an increase of 38,636 tons over the previous year, inspected at canneries for the purpose of establishing the grade under contracts between growers and the canners. Of particular interest was the inspection of truck crops on 29 farmers' markets in the North Central and Northeastern States where the Federal Surplus Commodities Corporation bought approximately 435,446 bushels of truck crops and turned them over to local relief agencies.

TABLE 1.—*Total inspections of fresh fruits and vegetables in stated years*

Year ended June 30	Shipping points	Receiving markets	Total	Year ended June 30	Shipping points	Receiving markets	Total
1919	----------	14,492	14,492	1935	306,441	53,443	359,884
1920	----------	25,488	25,488	1938	450,065	49,052	499,117
1925	131,087	32,334	163,421	1939	456,394	48,865	505,259
1930	243,129	44,740	287,869				

In receiving markets, fees for inspections for condition only were reduced from $4 to $2.50 on May 1, 1939. The reduction was made for the benefit of those who are interested in obtaining information on some single factor or factors of condition of their products and who do not need complete grade certification. The fee for complete grade inspection remains at $4. The reduction brought a material increase in the use of the service by both shippers and receivers during the last 2 months of the fiscal year.

MEATS

There was a further increase in the total quantity of meat graded. The service was maintained at 24 stations, including all of the principal meat-packing and consuming centers of the United States. The quantities of the different kinds of meat graded together with the percentage increase or decrease compared with last year are shown in table 2.

TABLE 2.—*Quantities of meat graded, 1939 compared with 1938*

Item	Graded during fiscal year 1939	Gain (+) or loss (−) over 1938		Item	Graded during fiscal year 1939	Gain (+) or loss (−) over 1938	
	Pounds	*Pounds*	*Percent*		*Pounds*	*Pounds*	*Percent*
All meats	670,251,418	+63,682,467	+10.5	Cured pork	35,471,143	+8,495,142	+31.5
Beef	545,428,209	+47,417,098	+9.5	Lard	859,295	+121,137	+.1
Veal and calf	5,716,338	−373,364	−6.1	Lard substitutes	110,973	−271,729	−71.0
Lamb and mutton	27,191,348	+985,573	+3.8	Sausage and ground meats	43,923,467	+4,881,896	+12.5
Pork	7,128,149	+3,621,047	+103.2	Miscellaneous	1,993,753	+38,613	+2.0
Cured beef	2,428,743	−1,232,946	−35.2				

GRAINS

The licensing of inspectors, the supervision of their work, and the handling of appeals under the Grain Standards Act, were negotiated with little difficulty, principally because of the good general quality of the 1938 grain crops, the absence of major grading problems, and close supervision. Inspection was performed at 174 markets in 30 States. There were 1,338,387 official inspections performed by inspectors licensed by the Government but not in its employ. These inspections represented a total of 2,250,000,000 bushels of grain, or in terms of carloads, 1,473,064 cars.

Federal district offices supervised approximately 200,000 of these inspections; and samples, representing 43,671 of these supervisory inspections, were examined and checked by boards of review to bring about, in fairness to all branches of the industry, uniformity of application of the standards at all markets. The grain-price structure is a sensitive one, and the inspection service must be kept on a firm and steady base if there is to be the proper reflection of merchandising values and grain qualities as portrayed by the Federal standards.

SOYBEANS

With a record production of soybeans in 1938 the volume inspected was greater than in any previous year. The total number of inspections was 26,547, or approximately 10,000 more than in the previous year. The inspection service was established at three new points—Little Rock, Ark., Omaha, Nebr., and Fostoria, Ohio. Export inspections were larger than those of any previous year and exceeded those of 1937–38 by approximately 2,400,000 bushels, making a total of 3,566,000 inspected for export.

Rules and regulations governing the inspection and certification of beans and peas were revised. These revisions clarify the provisions with reference to collection and disbursement of fees, the licensing of samplers, and the issuance of divided lot certificates on export shipments.

RICE

Permissive inspection of rough, milled, and brown rice is conducted partly as a direct Federal service and partly as a joint Federal-State service. Federal inspection laboratories were maintained at New Orleans and San Francisco. The total quantity of all kinds of rice inspected at Federal and Federal-State rice-inspection laboratories was 2,620,922 hundredweights. In addition, 1,305,975 hundredweights of rice exported were inspected and certified as to United States origin. A total of 9,143 certificates for grade, factor analyses, equal to type, and origin was issued. The quantity of rice inspected for members of the rice trade, exclusive of inspections made for the Federal Surplus Commodities Corporation, was considerably in excess of the quantity similarly inspected during the previous year.

TOBACCO

Among significant developments were the decision of the Supreme Court upholding the constitutionality of the Tobacco Inspection Act and the increase in sentiment for mandatory tobacco inspection. The

decision of the Supreme Court clears away the last legal obstacle to the further development of official tobacco inspection. Such local opposition as has existed heretofore appears to have diminished.

Referendums were held on 13 markets, and 12 of these had been designated for the inspection service prior to June 30. Designated markets at the close of the year numbered 37. One of the thirteen markets was Greenville, N. C., which for many years has ranked at least second and on one or two occasions ranked first in volume of sales compared with other flue-cured markets. This marks the first entry of mandatory inspection service into a market of the largest class. Rapid headway was made in perfecting the organization for expansion of the inspection work to meet the increased demands. The quantity inspected has increased from about 122 million pounds in 1935 to 275 million in the 1938–39 season. With the grade and market news information provided at the auction markets, the grower is able to protect himself against erratic price changes incident to rapid sales.

COTTON

An outstanding development of the 1938–39 season was the classing of cotton for groups of growers organized for quality improvement. Samples, aggregating 83,592, were classed for 226 organized groups in 15 States. This work was inaugurated the past season under the so-called Smith-Doxey Act (the amended Grade and Staple Statistics Act). A total of 312 improvement groups, representing 470,000 acres, was approved for the free classification and market news services. More than 900 groups, representing over 1,700,000 acres of approved varieties, will receive the free classification during the 1939–40 marketing season. The larger representation for the second season of this work seems indicative of an increased interest on the part of growers in better-quality cotton and improved marketing methods.

Two reports were issued on the quality of the cotton carry-over; 67 reports were issued on the quality of ginnings to specified dates in individual States and in the United States; and 127 semimonthly reports were issued on the quality of ginnings. Each cooperating ginner who furnished samples for classification for purposes of the quality reports was given a copy of the daily classification sheets showing numbers identifying the bales represented by samples classed. At the end of the ginning season each of the cooperating ginners was furnished a report containing a summary of the grade, staple length, preparation, and tenderability of crop samples classed from ginnings by their individual gins.

COTTONSEED

In 1937–38 the Department undertook the supervision of the sampling, chemical analysis, and grading of cottonseed when purchased on the basis of the official standards. The work was confined to the Mississippi Valley States. During 1938–39 the work was extended to Virginia, North Carolina, South Carolina, Georgia, Florida, and Alabama, and was carried out through a combination of cooperative agreements with the cottonseed-crushing mills.

Of the 105 active cottonseed-crushing mills in the Mississippi Valley States, 91 entered into voluntary cooperative arrangements. It is estimated that 90 percent of the cottonseed sold for crushing purposes in the Mississippi Valley was covered by official certificates of grade, and that approximately 68 percent of that sold in the Southeastern States was similarly sampled, analyzed, and graded according to standards.

DAIRY AND POULTRY PRODUCTS

Grading of butter, cheese, eggs, and dressed poultry continued at 11 major markets. Federal-State grading of butter and eggs was continued at various points in Iowa, Nebraska, Minnesota, Washington, California, Virginia, Maryland, Florida, Ohio, Indiana, Michigan, and North Carolina. Turkey-grading work was carried on at shipping points in 16 States. Inspections of dressed poultry were made at various plants in 12 States. Live-poultry inspection was discontinued at New York City. Of the 321 million pounds of butter officially graded during the year, more than 90 million pounds were sold in consumer packages with a certificate of quality showing the score at time of grading. Approximately 30 million pounds of dressed poultry (including 18 million pounds of turkeys) were graded, and 48 million pounds were inspected for condition and wholesomeness. Each year brings increased interest on the part of retail and consumer organizations in standardized grades.

DEMONSTRATIONS

Through educational and demonstrational programs the general public becomes more familiar with the standardization programs, with the various commodity grades, and with the position of the quality grades in the grading scale. A great many educational programs were held in cooperation with State extension services and other State and county agencies. At some of these meetings producers were taught to grade or to class various commodities; at others, grading was demonstrated by trained specialists.

Last year 22 cotton "schools" made it possible for those participating to become acquainted with the various grades and staples of cotton represented by the official standards and with the principles of cotton classing. One or more Federal classers demonstrated the standards and gave instructions in cotton classing. These schools encourage farmers to improve the quality of their cotton and to market their crop on the basis of quality. The classification and market news services, as authorized by the Smith-Doxey Act, were explained at 145 meetings. At these meetings, instructions were given to approximately 7,200 growers on the proper manner of filing applications, and on the purpose, requirements, and benefits of the services.

Tobacco-sorting demonstrations were held in eight States. Attendance at tobacco-grower meetings and demonstrations totaled about 54,000 persons. Training courses were held at eight agricultural colleges and institutes for the particular benefit of college students and agricultural teachers. Exhibits of tobacco samples representing the various grades were shown at eight agricultural fairs.

Educational work pertaining to wool and mohair was carried on in 11 States. These programs stressed the practical aspects of wool-marketing problems.

Grain standards were demonstrated at 75 meetings. These meetings, held in cooperation with the Extension Service, were attended by 10,000 grain producers, dealers, consumers, county agents, and high-school teachers of agriculture. Most of the meetings were held in the surplus-producing areas. Nearly 3,000 type samples, illustrating the various classes and grades of hay, were distributed to extension specialists and other educational workers as a part of the hay-quality extension program.

Requests for livestock-grading demonstrations were received from 14 States. In Virginia and West Virginia, especially, a marked increase in the number of requests for demonstrations was noted. About 10,000 people attended the demonstrations in Virginia, West Virginia, Tennessee, and North Carolina, and about 210,000 spring lambs were graded and sold.

Many livestock demonstrations have been conducted in connection with shows by 4–H Club members and Future Farmers of America chapters. The carcasses of animals were graded, in some instances, in the presence of producers and club members, and the factors that determine grade were explained. In a few demonstrations, a small number of animals were numbered, graded, and slaughtered, and the carcasses regraded to check the accuracy of the grading of the live animals.

Federal turkey-grading schools were held in practically every important turkey-producing State. The work was carried on in cooperation with a State agency, usually the State department of agriculture, or with marketing specialists from the State colleges. Approximately 3,000 producers, hatcherymen, graders, marketing specialists, and county agents attended. The Federal schools are followed by similar schools held in different parts of the States by a Federal-State supervisor. At the latter schools the attendance ranged from 25 to several hundred.

The primary purpose of these programs is to acquaint the general public with the grades and to bring to the attention of producers and shippers the marketing practices that help to maintain high quality. Indirectly, the educational activities serve to improve the quality of marketings, to show farmers how to sell on the basis of grade, and to help producers interpret market reports more intelligently.

NUMEROUS RESEARCH PROJECTS

Research was concerned largely with the development and improvement of the standards for quality. The projects included cotton-fiber and spinning-fiber tests, milling and baking tests made with wheat and other grains, slaughter tests of different grades and weights of livestock, and wool-shrinkage studies. The standardization research involves the determination and appraisal of all factors inherent in a product, and in different varieties of that product, that may in any way affect its commercial value or relative desirability. The perfecting of inspection equipment and techniques was continued, for it is desirable to eliminate insofar as possible the errors of personal judgment or observation in the inspection procedure.

Of major importance also were the studies to improve the accuracy of crop forecasts, the market-reporting surveys, the marketing studies

in specific producing areas, and the research projects on such phases as packing, packaging, handling, storing, and warehousing farm commodities.

QUALITY-OF-MEAT STUDIES

In the quality-of-meat project, the grades of slaughter animals and of their carcasses, together with the grade factors constituting each, were recorded and analyzed. Such information makes it possible to compare live-animal characteristics and the yields, measurements, and histological, chemical, and physical characteristics of the meat with standard grades. This continuous project is being conducted in cooperation with the Bureau of Animal Industry. Sufficient data already are available on some of the more important grades but are yet lacking on the extreme high and low grades.

The first year of study was completed of beef produced from Medium and Good grade 3- and 4-year-old Hereford steers, fed on grass alone, compared with beef from similar cattle fed a standard grain-and-hay ration in dry lot. This study was conducted in cooperation with the Bureau of Animal Industry, Bureau of Home Economics, Virginia Agricultural Experiment Station, and the Virginia Division of Markets. Preliminary results of the first year's work indicate no significant differences between the two groups of cattle with reference to gains in weight, carcass grades, thickness of fat, and tenderness and flavor of the cooked meat.

In a number of other meat-quality studies emphasis was placed on the relationship between specified characteristics of slaughter animals and their carcasses by grade. Measurements and detailed data of such factors as the percentages of wholesale cuts by grade, and the percentages of lean, fat, and bone by grade, obtained for a large number of carcasses, are being used in a comprehensive study of carcass measurements and of other characteristics in relation to grade. These studies provide a basis for making necessary revision in grade standards in order to correlate closely the live-animal grade with its carcass grade.

A study also was conducted on the grades of live lambs and the carcasses produced from the lambs. This was for the purpose of facilitating a comparison of quotations for live lambs with those of lamb carcasses and a comparison of quotations at different markets on the basis of grade. The result was the adoption of a method of quoting live lambs by grade that enables market reporters more accurately to report prevailing prices in terms of market grades than was theretofore possible.

THOUSANDS OF TESTS WITH GRAINS

More than 20,000 physical and chemical tests were made to provide information necessary for the proper consideration of changes in the standards for the various grains and for the improvement of inspection technique. Several thousand mechanical tests were made with a view toward improving the inspection equipment. Much effort has been devoted to a simplification of the official methods for determining moisture and soundness in grain, and properties of barley and of malt, as well as standardizing and simplifying the various chemical and physical tests for determining the properties of wheat and other grains.

Investigational activities pertaining to rice standards and inspection were directed principally toward amendments to the rough-rice standards on the factor of moisture, and a revision of the milled-rice standards that would make them more nearly conform with present-day merchandising practices. Recommendations for these changes to become effective early in the 1940 fiscal year have been made. Studies of the proper stage of maturity at which to cut rice to produce maximum milling quality were concluded and the results published in Circular No. 484.

Consideration is being given to a change in the standards for soybeans that will make foreign material a dockage factor instead of a grading factor. No changes were made in the hay or straw standards, but preliminary studies were made with cowpea hay for the purpose of establishing tentative standards for this type.

Associated with the issuance on October 10, 1938, of tentative standards for dockage in country-run timothy seed, studies of various types of equipment were made to facilitate the determination of dockage. Dockage investigations were carried on with sweetclover, Sudan grass, and lespedeza seed.

OTHER MARKET SURVEYS

A survey covering milk and cream receipts at New York City was completed, and the results were given in a mimeographed report entitled "Receipts of Milk and Cream at New York." The work was done in cooperation with the New York State College of Agriculture.

Progress has been made in collecting information at Chicago regarding sales of butter and eggs through retail stores. The work in that market indicates possibilities of obtaining further measures of consumption in a similar manner. Preliminary work of the same nature is under way at Philadelphia. Another study made at Chicago indicates that local wholesale prices of cream bear a more or less definite relationship to prices of butter. Cream prices vary to a considerable extent, depending upon utilization, rather than upon grade and quality of product.

A study of the quality of butter offered in retail stores at New York City and Chicago showed that consumers who wish to obtain 92- or 93-score butter will find it more consistently by buying butter packaged with certificates of quality than by following advertisements printed on butter packages.

A growing problem in the field of reporting wholesale prices of dairy and poultry products is the declining volume of open wholesale trading, as a result of direct buying in the country by chain stores, the establishment of local distributing branches by cooperative associations and corporations, industry consolidations, and other factors. A study is being made of this problem, from the standpoint of market-reporting methods, and the uses of present types of market information. Preliminary results indicate that development of prices paid f. o. b. market may be the logical basis for reporting. Quality and price relationships at various stages in the marketing process also enter into the problem.

Various fruit and vegetable marketing studies were conducted. Some of these relate to specific crops or producing districts. An example of this type of work was the study of certain factors relating

to the marketing of Louisiana strawberries. Two of the principal problems considered were distribution costs and price spreads between shippers and wholesalers or retailers in the city markets.

Increasing emphasis is being placed on statistical analyses by Federal-State and private agencies in working out plans for solving fruit- and vegetable-marketing problems. Copies of the inspection certificates that show the number and kind of packages in the carloads inspected and other important information are valuable sources of statistical data. Approximately 50 percent of all carlot shipments of fresh fruits and vegetables during the year were inspected at shipping points. The certificates are being analyzed to obtain data on the average quantities loaded per car, proportion of shipments in specified containers, and leading varieties.

COTTON-FIBER RESEARCH

Substantial progress was made in the development, application, and refinement of technique and apparatus needed for more accurate and economical measurements of cotton-fiber quality. A special effort was made toward greater distribution and application of the more important research findings. Important is the appreciable evidence that many of the developments are being applied and are yielding benefits in helping to solve problems of cotton-quality standardization, classification, and marketing, on the one hand, and of cotton-breeding and production-improvement programs, on the other. Fiber and spinning studies were carried on cooperatively with the Bureau of Plant Industry, the Clemson Agricultural College of South Carolina, and the Agricultural and Mechanical College of Texas; ginning studies were carried on jointly with the Bureau of Agricultural Chemistry and Engineering.

Color investigations included continuation of the cotton-color survey, the studies of color stability in cotton held in storage, and the regional variety color studies. The regional variety studies disclosed that the color of cotton depends much more on environmental conditions than on variety. Color changes as related to temperature, rainfall, and other climatic conditions will be considered during the present year.

Material progress was made toward automatic recording, through a cotton-scanning instrument, measurements of color, leaf, and preparation factors. Another instrument is in process of development for automatically measuring and recording fiber lengths by means of a special photoelectric hook-up. Work with the fiber-length meter machine will be continued.

Considerable interest has been evidenced in the artificial-daylight installation that was made in the Washington laboratories in 1937. Various illuminants are now being offered commercially as daylight substitutes, and technical studies have been instituted to compare the efficacy of certain of these proposed substitutes with lamps now used in the Department's artificial-daylight room.

Physical property studies have brought forth interesting conclusions as to the manner in which various fiber properties affect yarn strength in different ways, depending on variety. The comparative

tests of cotton varieties by regions have been concluded for the 1935 crop and will be continued for the 1936 and 1937 crop years. It would seem important, however, to have some more or less continuous testing of these properties, from year to year, of the principal varieties of American upland cottons grown across the belt, and to issue periodic reports on the findings with respect to fiber properties and spinning quality, much as the Indian Government is doing. This information would give the Department and the various States a more adequate basis for detecting instability in and for improving American cottons; for making selections and rejections with respect to cotton breeding, production, single-variety communities, and other improvement programs; and for advising with the textile industry and the cotton trade as to the availability of supplies and sources of raw cotton with specified fiber and spinning properties.

Studies of physical properties have embraced mechanical and X-ray examinations and tests over a large number of cottons. An analysis of the data from 100 lots of cotton, varying widely in measured strength, showed that strength of the fiber is highly dependent on structural arrangement of cellulose, which can be measured by an X-ray method. Since the structural arrangement has such an important relation to the strength and perhaps other properties of the fiber, it bids fair to be one of the more important criteria of quality in raw cottons. In addition, measurement of this property should be of great assistance in cotton-breeding and physiological studies.

With the purpose of finding a method for measuring maturity of cotton fibers that would avoid the tedious and time-consuming process of observing fibers, individually, under the microscope, a study was made of the change in chemical composition of the fiber with progressive thickening of the cell wall. These determinations can be made on aliquot portions of thoroughly mixed larger batches of fibers. The method automatically eliminates a number of sampling problems and difficulties commonly associated with the physical testing of fibers. It also simplifies and expedites the sampling procedures.

The maturity of fibers is important largely according to the extent to which immaturity causes mill or manufacturing difficulties. These studies are being continued and will be extended to commercial samples of cotton lint.

COTTON-GINNING STUDIES

Cotton-ginning investigations were conducted in cooperation with the Bureau of Agricultural Chemistry and Engineering. In the field of artificial drying, studies have shown how the utilization of engine waste has lowered operating costs of drying cotton and made the process more feasible for plants operating with internal-combustion engines. A household-type furnace was found to have sufficient capacity to dry cotton for two-stand or three-stand gin outfits. During the past season the drying process recommended by the Department was used in over 800 gins where approximately 1 million bales of cotton were ginned. Other studies concerned gin capacity, roller gins, screens for seed-cotton cleaners, the use of extractor

feeders in successfully cleaning sea-island cotton, and grade improvements brought about by drying in storage prior to ginning.

Extension of the findings and recommendations affecting cotton ginning appears to be resulting in more careful harvesting and ginning. Since the inauguration of the gin extension program in Louisiana in 1935, the State Extension Service, in a survey of two-thirds of the gins in the State, found that 150 gins have made major improvements at an aggregate cost of 1½ million dollars. The improvements include driers, cleaners, extractor feeders, new gins, saws, brushes, fronts, and stands. Improvements of a similar nature and extent are being proportionately made in ginning equipment and practices in all of the cotton States.

COTTON-SPINNING TESTS

Spinning and testing operations at the South Carolina laboratory have been suspended since October 1938 owing to conditions associated with the transfer of the quarters to a new building. Tests for the full period, however, were conducted at the Texas laboratory.

More than 300 lots of cotton of different varieties and from different regions (regional variety studies) were subjected to fiber and spinning tests. Fiber-bundle strength and fineness of fiber were found to be definitely associated. Also the coefficient of length variability is inversely correlated with the coefficient of fineness variability, suggesting that fiber breakage is responsible for an appreciable amount of variability of fiber lengths.

Spinning studies included tests of seven varieties or strains produced under irrigated conditions (at four stations) in the Southwest for the 3 years 1935–37. These tests, only partly completed, already have yielded valuable findings.

Samples of cotton classed as "immature" were found to possess very high percentages of immature fiber—in some cases as much as 76 percent; but, contrary to the classers' designation, the cottons had fairly good fiber strength. Spinning tests showed that yarns and cords made from the immature cotton were of fairly good strength but rough in appearance. The cottons yielded high percentages of waste in manufacturing, and gave considerable trouble in that they threw off objectionable amounts of fly waste and caused roller laps. Thus, manufacturing costs would be higher than for normal cottons.

COTTON PACKAGING AND SAMPLING

A research study of cotton packaging was started in cooperation with the Bureau of Agricultural Chemistry and Engineering. The objectives of the study are to ascertain the effects of various bale sizes, weights, shapes, and densities on the cost of handling and packaging. The studies embrace consideration of the mechanical and economic feasibility of providing high-density press equipment at gins and for the operation of gins to assure the packing of each bale with cotton of uniform quality. Means for the elimination of air cutting, band channel cutting, and other forms of fiber damage associated with the process of recompression of bales are being studied, as are means for preventing bale buckles and other particles of metal from becoming embedded in the lint during the process of recompression

of bales. Possibilities for the integration of mechanical sampling and permanent bale identification with high-density compression also are being considered.

A preliminary survey made after the project was approved in January 1939 has developed comprehensive information relative to existing compress equipment in this country, and present practices and costs for gin packaging and recompression. The information will serve as a basis for later studies of comparative costs, advantages, and disadvantages of present methods of gin packaging and recompression contrasted with high-density packaging at gins.

Plans have been worked out for a series of tests, to be conducted at the ginning laboratory at Stoneville, Miss., during the 1940 season, covering all available types of cotton-packaging equipment, cotton of various qualities and conditions, and various types of bale-covering materials.

Work in connection with the development and laboratory testing of mechanical sampling equipment—equipment that can be geared into gin machinery so as to obtain by automatic processes a representative cross section of the bale as it is being ginned—also is being conducted at the Stoneville laboratory. Such a device must have a relatively low cost and give a sample truly representative of the bulk of the lint cotton composing the completed bale.

WOOL-SHRINKAGE RESEARCH

Domestic grease wools shrink from 35 to 75 percent in the scouring process. This shrinkage averages about 60 percent for the entire United States. Since the price that growers receive for their wool is partly determined by the percentage that buyers estimate it will shrink when scoured, it is essential that growers have some way of determining the shrinkage of their wool before they sell it.

In recent years top makers and manufacturers have been obtaining an increasing proportion of their grease-wool supplies direct from growers or from auction markets in producing areas. With this development in wool marketing, growers are becoming increasingly interested in improving their selling techniques. They want to be able easily and readily to ascertain the value of their wool while it is still in their possession. Therefore, at the request of grower organizations, an extensive research project was inaugurated to find a simple, practicable means of ascertaining shrinkage (the greatest price-determining factor in grease wool) that can be readily applied by the grower or his agent and that will be acceptable to buyers and sellers alike. Numerous tests were undertaken and various sampling techniques were tried in the Washington laboratory. In the initial tests, efforts are being made to develop a method of selecting from a clip of wool a very small sample that has the same shrinkage as the entire clip from which it was taken.

Observation and study were also given to developments in marketing that may affect the grower beneficially or adversely, such as the public-auction method of selling wool, the operations of order buyers, the inauguration of marketing services, and the growth of interest in the so-called warehouse method.

RULES OF FAIR PLAY

Firms engaged in handling agricultural commodities have, in general, earned the confidence of producers in all sections of the country by following a policy of fair dealing.

A few producers and a few dealers, however, endeavor to engage in fraudulent, unfair, and discriminatory practices. Dealers may pay lower prices than the condition of the market warrants. Producers may ship commodities that are unfit for the channels of trade. Unauthorized agents may defraud producers by making false claims as to their principals. These practices violate the rules of fair play. Furthermore, claims arise from producers or dealers when no dishonesty is involved. A Florida grower, for example, may ship a car of tomatoes to a dealer in New York City. Although the fruit may be in good condition when it leaves Florida, the condition on arrival may cause it to be rejected by the dealer. In such cases, the rival claims of the shipper, the carrier, and the dealer must be investigated and adjusted by an impartial agency.

The machinery for regulating the relations of producers and dealers is set up under a number of specific acts of Congress. In all, the activities of the Agricultural Marketing Service involve the administration of 17 specific statutes, among them the Cotton Standards Act, Cotton Futures Act, Grain Standards Act, Packers and Stockyards Act, Perishable Agricultural Commodities Act, Standard Container Acts, Produce Agency Act, Export Apple and Pear Act, Dairy Exports Act, Tobacco Inspection Act, Warehouse Act, and Federal Seed Act. Among these statutes there are also certain market "service" acts—Cotton Grade and Staple Statistics Act, Tobacco Stocks and Standards Act, Peanut Statistics Act, Wool Standards Act, and the Farm Products Inspection Act as provided for in annual agricultural appropriation acts.

THE UNITED STATES WAREHOUSE ACT

Under the authority of the United States Warehouse Act, warehousemen may be licensed for the storage of agricultural products. Thorough investigations are made relating to the integrity and financial responsibility of the warehouseman, the integrity and competency of samplers, weighers, inspectors, and graders of products stored, the physical structure of the warehouse, and the quantity and grade of the products. The receipts of a federally licensed warehouseman are generally accepted without question as collateral for loans.

The obvious advantages of licensing led to a marked increase last year in the volume of commodities that could be stored in federally licensed warehouses. At the close of the year, 1,159 warehousemen had been licensed—an increase of 14 percent over the number the preceding year. The inspectors, samplers, weighers, and graders licensed totaled 2,808—an increase of 13 percent. Most progress was made in the licensing of warehouses storing cotton, grain, wool, and canned goods. The heavy accumulations of cotton under the Government loan program resulted in additional requests for licensing. Last year, more cotton than ever before could be stored in federally licensed warehouses.

Terminal grain elevators of substantial capacity were licensed at Maumee, Ohio; at St. Louis and St. Joseph, Mo.; and at Buffalo, N. Y. A number of country elevators were licensed, particularly in the southwestern wheat area. These elevators served the farmers directly and assisted in carrying out the crop-insurance and Government loan programs in that area.

In the same area, particularly in Texas and New Mexico, a number of large wool warehouses were licensed. This licensing of wool warehouses in the production areas has been of material advantage in the financing of growers under the loan program of the Commodity Credit Corporation.

A new office was opened at Memphis, Tenn., through which the western one-third of Tennessee and the northern two-thirds of Mississippi will be served. This makes the ninth field office maintained for administering the Warehouse Act.

THE FEDERAL SEED ACT

The administration of the Federal Seed Act was transferred from the Bureau of Plant Industry to the Agricultural Marketing Service in October 1938. This act, passed by Congress in 1912, regulates imports as to quality of approximately 20 kinds of seed entering this country, and by amendment in 1926 prohibits fraudulent misbranding of seed in interstate commerce. Through the help of the States, great improvement has been brought about in the labeling of seed in interstate commerce. The act of 1912, however, did not require that seed be labeled and did not restrict the movement of seed containing noxious-weed seeds. And increasing importations of forage-crop seed required to carry out the Department's soil conservation recommendations make imperative the control of the quality of such imported seed.

In view of the inadequacy of existing legislation, extensive consideration has been given during the last 2 years by the Department, State officials, the American Seed Trade Association, and farm organizations to new legislation. These efforts resulted in the passage of a new Federal Seed Act (signed August 9, 1939). The new law, effective in 1940, will control the quality of all imported agricultural and vegetable seeds, and restrict the importation of screenings and seeds containing noxious-weed seeds. The interstate provision of the law will require complete and correct labeling of seeds in interstate commerce. It further will restrict the movement of noxious-weed seeds in interstate commerce on the basis of the requirements of the States into which the seed is shipped. False advertising in interstate commerce is prohibited. Proposed regulations under the act have been outlined and will be discussed at public conferences and hearings to be held prior to their promulgation.

THE PACKERS AND STOCKYARDS ACT

The Packers and Stockyards Act is intended to prohibit unfair practices in the marketing of packing-house products, livestock, and live poultry in interstate commerce, and to establish reasonable rates for services rendered in the handling of livestock and live poultry. (Prior to October 1938, the act was administered by the Bureau of Animal Industry.)

Last year more than 35 million dollars was collected by 132 stockyard and 780 livestock commission agencies for yardage, feed, other stockyard services, and for buying and selling livestock on commission. The act authorizes the Secretary of Agriculture to investigate these charges and to establish just and reasonable rates in lieu of those found unreasonable.

At the close of the year, 181 stockyards were posted under the act—an increase of 15 during the year. Approximately 4,600 market agencies and dealers were registered to operate at such stockyards. The number of cases receiving final action totaled 132, and there were 37 pending at the end of the year. Sixteen poultry markets were under supervision and approximately 1,700 licenses were in effect at these markets.

Livestock is sold at auction at many of the newly posted stockyards. Certain novel problems of regulation are encountered at these markets because of the manner in which the business is conducted. A study, therefore, was started to determine what additional regulations might be necessary in order to insure adequate supervision. Preliminary studies were started covering the rates and charges for handling and selling.

An appraisal of the property and an audit of the books and records of a large stockyard company were completed. Conferences were held with representatives of the company, and an agreement on all matters in controversy was reached. This agreement will be used to establish a fair-rate base and a fair rate of return.

A number of interesting and important trade-practice matters arose during the year. One of the cases involved the practice of an agency allowing a country buyer to draw drafts on it in payment of the purchase price of livestock bought from producers. The livestock was later shipped to the agency to be sold. The agency, however, refused to pay a large number of drafts on the ground that the country buyer was not its agent. As the result of a hearing the registration of the agency was suspended. Another case involved counterfeiting of scale tickets by certain dealers on one of the larger markets. In this case the dealers obtained blank copies of scale tickets and executed them in a manner to make them resemble official tickets. They were then used to deceive purchasers of livestock and to deprive the stockyard company of certain lawful charges in connection with the weighing of livestock. The registration of the principals in this case was suspended for a year.

In a large number of complaints received during the year reparation was sought for damages alleged to have resulted from unfair practices. It was possible to settle some of these cases through informal action, but others were of such character as to require formal proceedings.

PERISHABLE AGRICULTURAL COMMODITIES ACT

The Perishable Agricultural Commodities Act is intended to suppress unfair and fraudulent practices in the marketing of fresh fruits and vegetables in interstate and foreign commerce. Practices considered unfair are the rejection or failure to deliver without reasonable cause, the making of a false or misleading statement for a fraudulent purpose, failure truly and correctly to account, and misrepresentation of the grade, quality, or condition of fruits or vegetables. The act also

requires all commission merchants, dealers, and brokers who handle fresh fruits or vegetables in interstate or foreign commerce to obtain a license from the Department of Agriculture.

At the end of the year, 19,955 licenses to commission merchants, dealers, and brokers who handle fresh fruits and vegetables in interstate or foreign commerce were in effect—an increase of 176 over the previous year.

During the year 2,396 complaints of unfair conduct were received—an average of 46 per week. Informal, amicable settlements were accomplished in 819 cases, involving payments of approximately $276,000. Formal orders were issued by the Secretary of Agriculture in 325 cases, 242 of which involved reparation awards of approximately $102,000. Thirteen licenses were revoked, as authorized by the act, and 12 licenses were conditionally or definitely suspended by order of the Secretary. Through failure to pay reparations as ordered, 69 licenses were automatically suspended by operation of law. Personal investigations were made in 354 cases.

Wholly outside of formal or informal action taken by the Department is the effect of this act and its enforcement on the practices followed by the trade. Since the act is intended to suppress unfair and fraudulent practices in the marketing of fruits and vegetables, it is obviously more important to prevent licensees from engaging in unfair and fraudulent practices than to punish them for such practices after they have occurred. There has been a marked decrease in the number of unjustified rejections by receivers, and shippers apparently are becoming more punctilious in carrying out their contracts. It is evident, too, that commission merchants handling goods for the account of others are becoming more careful and accurate in rendering sales accounts.

For sale by the Superintendent of Documents, Washington, D. C. - - - - - Price 10 cents

REPORT OF THE CHIEF OF THE BUREAU OF ANIMAL INDUSTRY, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., September 20, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith the report of the Bureau of Animal Industry for the fiscal year ended June 30, 1939.

Sincerely,

J. R. MOHLER, *Chief.*

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GENERAL SCOPE OF ACTIVITIES

The work of the Bureau of Animal Industry dealt, as formerly, with the prevention, control, and eradication of animal diseases and parasites, the administration of various Federal livestock laws, inspection work, and research.

The Bureau has continued to concentrate its efforts, with notable success, on several major activities, notably the suppression of tuberculosis, Bang's disease, and tick fever. Meanwhile it continued its customary administrative, regulatory, and research functions.

An outstanding research achievement of the year was the discovery that the chemical, phenothiazine, is a highly effective anthelmintic for the removal of most of the injurious internal parasites of sheep and many of those of swine. As given at a dose rate of 0.5 gram per pound of body weight, the chemical is nontoxic as well as relatively inexpensive. Its use makes possible one treatment to free animals of various parasites whereas formerly several treatments with different chemicals were frequently needed. With the view of making the product available to veterinarians and the public at minimum cost, the Bureau has applied for a public-service patent, so that the field of preparation and distribution may be open to all interested manufacturers. Commercial production of the chemical in a form suitable for use as an anthelmintic has begun.

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BUSINESS ADMINISTRATION

By performing various duties relating to the Bureau's work as a whole, the administrative offices coordinated fiscal affairs of the various divisions and provided personnel, editorial, and library services. Approximately 170,000 vouchers and claims were received and certified for payment, involving an expenditure of about $18,500,000.

During the year 4,195 purchase orders, many involving the acceptance of bids, were issued, representing an expenditure of $357,991. In addition, supplies valued at approximately $24,000 were procured from the Central Supply Section of the Department on requisition. The installation of the new uniform system of property accounting, prescribed by the General Accounting Office and begun during the previous year, was completed.

Approximately 175,000 pieces of incoming mail and about the same number of outgoing letters and other mail were handled.

LIBRARY SERVICE

Through the Bureau's library, 41,666 periodicals and 4,659 books were circulated to the Bureau staff in Washington. A card index of medical periodical literature, developed in the Bureau, now contains about 280,000 author and subject cards, for the use of the research staff. A branch library was established at Beltsville, Md., to serve all Bureau units at the Agricultural Research Center.

PERSONNEL

At the end of the year there were on the Bureau's rolls 4,286 regular civil-service employees in the various grades, divided as shown in table 1.

TABLE 1.—*Civil-service employees of the Bureau in the various grades, fiscal year 1939*

Service	Employees in—		Total employees
	Departmental service (in Washington, D. C.)	Field service	
	Number	*Number*	*Number*
Professional and scientific	65	1,979	2,044
Subprofessional	18	1,633	1,651
Clerical, administrative, and fiscal	163	371	534
Custodial	15	42	57
Total	261	4,025	4,286

Of the 2,044 employees in the professional and scientific service, about 92 percent were veterinarians. In addition to the foregoing figures for graded employees, there were on the rolls 642 ungraded employees, mostly agents and unskilled laborers. There were also 976 per diem employees whose services are utilized intermittently as necessary. During the year 62 employees were retired under the Civil Service Retirement Act. Of these, 41 were retired on reaching the statutory ages of 70, 65, or 62, depending on the type of service

performed; 11 elected to exercise the privilege of optional retirement during the 2 years previous to reaching the statutory age; and 10 retired on account of disability.

VETERINARY EDUCATION

During the year 471 students graduated from accredited veterinary colleges, an increase of 56 as compared with the preceding year. The total enrollment was 2,480, an increase of 23.

There are 10 accredited veterinary colleges in the United States, the number being unchanged from last year. The number of foreign recognized veterinary colleges, 14, remains unchanged.

PUBLICATIONS AND EXHIBITS

Publications prepared by the Bureau and published by the Government included 55 new and revised documents. These dealt principally with the production and care of livestock, disease prevention and control, results of research work, and administrative matters. In addition, Bureau employees contributed 215 manuscripts to periodicals published outside the Department or for reports of scientific organizations. These papers dealt with the various phases of livestock work and research.

As in former years, the Bureau furnished the Press Service and Radio Service of the Department with numerous articles for publication and material for broadcasting. Bureau employees also participated in radio broadcasts from Washington, D. C., and field stations.

In cooperation with the Extension Service, the Bureau continued to furnish subject matter for new and revised exhibits, motion-picture films, film strips, and similar pictorial matter. A particularly extensive exhibit was prepared for the Seventh World's Poultry Congress, held in Cleveland, Ohio, July 28 to August 7, 1939. Material was likewise furnished for the world's fairs in both New York and San Francisco, as well as for State fairs and various expositions.

The research and regulatory work of the various branches of the Bureau is presented more fully on the following pages.

ANIMAL DISEASE STATION

The Animal Disease Station, at Beltsville, Md., continued its independent investigations of certain animal diseases, under A. B. Crawford, as acting superintendent, to October 17, 1938, and since that time under Adolph Eichhorn, Director. The professional personnel was increased to 12, and many additions and changes were made to the laboratory, notably provision for the production of all antigen used in the Federal-State cooperative project for the control of Bang's disease.

BRUCELLOSIS

The study of brucellosis has been continued to obtain further data on efficacy of vaccination and to determine the possible connection of species of animals other than cattle in the continuance of the infection in some herds of cattle, and to develop improved methods for the practical application of the eradication program pursued by the Bureau.

It has been recognized by those making blood tests of animals in the various States that one of the essential factors for obtaining dependable and uniform results is the use of a standardized antigen. Livestock sanitary and veterinary associations have called attention to variance in the antigens prepared by the various State laboratories and have repeatedly expressed a desire that the Bureau undertake the production of antigen to be supplied to all laboratories engaged in official testing. Accordingly, the Bureau has equipped the Animal Disease Station with facilities for the production of all antigen used for that purpose, and arrangements were made to commence distribution July 1, 1939.

Since last year's report on calfhood vaccination against brucellosis, an additional year's experience in the field tests, begun in 1936, on approximately 10,000 calves vaccinated in 261 herds, has furnished further encouraging results. Data accumulated on these tests show that the vaccination of heifer calves in infected herds increases their resistance to infection during their first and second pregnancies and also, in the case of the limited numbers for which data are available, through their third pregnancy. It is deemed advisable, however, to continue observations on these herds before arriving at definite conclusions as to the dependability of calfhood vaccination as a control measure.

In experiments recently made, it was shown that saline suspensions of strain 19, the *Brucella* organism used in calfhood vaccination, remained alive in the tissues of an animal at the site of injection for a period of 60 days. This finding is contrary to the fate of many vaccines used in various other diseases, which either are absorbed or lose their viability within a few hours to a few days after injection. Further experiments are now under way to determine whether the culture mixed with various other excipients might not retain its activity in the injected animal for a longer period than in the saline suspension and thereby induce a higher degree of immunity. Increasing the animal's resistance through vaccination would undoubtedly be of advantage in the establishment of a lasting immunity in the animal.

Various publications of the Bureau reporting favorable results of calfhood vaccination have unquestionably stimulated the application of the procedure in the field. Recognizing the importance of having only dependable *Brucella* vaccine distributed by licensed laboratories, the Bureau rigidly supervises its production. Samples of each batch produced are tested for purity, viability, and density.

In the current literature on brucellosis, many references have appeared showing that in the region of the Mediterranean Sea, in the Balkan States, and in the Union of Soviet Socialist Republics, brucellosis in sheep is of frequent occurrence. In order to ascertain whether brucellosis may be present in sheep in the United States, 1,557 representative samples of blood from ewes killed in abattoirs in Illinois, Minnesota, Colorado, Texas, California, and Oregon were tested. Of these samples, 1,542 were completely negative to the agglutination test, 10 showed agglutination in a titer of 1:25, 4 in a titer of 1:50, and only 1 in a positive titer of 1:100. These results indicate that brucellosis in sheep is of rare occurrence in the United States.

TUBERCULOSIS

With the eradication of tuberculosis reaching its final stages, it has become increasingly apparent that some animals become sensitized to tuberculin by agents other than the bovine tubercle bacillus. One of the most disturbing factors in this connection is the so-called skin-lesion reactor. It has been known for some time that certain cattle showing small swellings or nodules under the skin of the legs tend to react to tuberculin. Such animals may be found in herds from which tuberculosis has been eradicated or in herds in which tuberculosis has not occurred. In these nodules micro-organisms similar in staining characteristics to tubercle bacilli are frequently observed. Since similar organisms are known to occur in soil, it is presumed that they gain entrance through wounds in the skin, setting up a local lesion and a sensitization to tuberculin. Such instances have been reported from various sections of the United States and very recently in several European countries, and have resulted in special investigations to determine to what extent reactions to tuberculin may now be attributed to such nonspecific causes. Although these investigations have been in progress for many years, the results have thus far been inconclusive, and it is desirable to find some procedure whereby such reactions may be properly interpreted in the eradication program.

An opportunity for such studies recently occurred at this station in an experimental herd previously negative to the tuberculin test, in which animals became slightly positive to tuberculin following the rupture of a skin nodule in another animal. In another group of young animals a large percentage developed a slight sensitization to tuberculin after being kept on a low marshy pasture for 6 months. An intensive study of the sensitization to tuberculin in these cattle is being made in the hope of developing data applicable to the control of similar conditions observed in the tuberculosis-eradication program.

A study was completed in connection with the possible spread of tuberculosis and other communicable diseases to animals coming in contact with the effluent of modern sewage-disposal plants. The sewage of the various units of the Agricultural Research Center, of which the Animal Disease Station is one, is carried to a common sewage-disposal plant of modern type, where it is chlorinated, passed through settling tanks, aerated, and filtered through large beds of crushed rock. The fluid portion of the sewage as it leaves the disposal plant after various treatments, known as effluent, was fed thrice weekly for a period of 6 months to healthy cattle and swine at this station. These animals were carefully observed during this period and for a further 6 months, after which they were killed. A thorough post-mortem examination of each of these animals failed to show any evidence of disease as a result of this feeding, indicating that sewage-disposal plants of modern type are very efficient in rendering sewage harmless.

Thirty samples of commercial tuberculin prepared for veterinary use were tested for purity and potency. Two samples were found to be contaminated with dead acid-fast organisms similar to tubercle bacilli, one was contaminated with other micro-organisms, and three were deficient in potency. The lots represented by the six samples were ordered withdrawn from sale.

VESICULAR STOMATITIS

Studies on vesicular stomatitis, which clinically resembles foot-and-mouth disease, have been continued, and knowledge pertaining to the virus of this infection has been materially advanced. The successful cultivation of the virus in chick embryo has made it possible to obtain the infective agent of this disease in any desirable amount for immunological studies. A notable advancement in the preservation of the virus of this disease was made when it was proved that if dried in vacuo its ability to reproduce the disease was not diminished after 6 months. It was found that 11-day-old chick embryos are best suited for growing this virus and that the maximum growth is reached in these embryos 40 to 48 hours after inoculation. Experiments are under way in the preparation of a vaccine against this disease similar to that used against equine encephalomyelitis.

MASTITIS

In the investigation of bovine mastitis during the year, further work was undertaken to determine the value of sulfanilamide in the treatment of chronic streptococcic mastitis. The same dosages of the drug were used and the same concentration of sulfanilamide was produced in the blood and milk as stated in the last annual report. The results of this work indicated that the streptococci were suppressed temporarily while the drug was being administered, and that as soon as the treatment was discontinued they reappeared. One cow died several days after the inception of the experiment and, on autopsy, it was found to have Johne's disease.

An experimental herd of 16 cows, purchased at different times as first-pregnancy heifers and kept isolated from all known sources of mastitis, has been studied for 3 years to determine the effect of lactation on the udder. Of this number, 8 are well along in the third lactation period and 1 has just calved for the third time. Three more cows have completed the second lactation period and 4 others the first. Ten cows passed through the first lactation period without any udder trouble as indicated by changes in the milk. Of the 12 cows with 2 complete lactation periods, only 3 could be considered to be free from mastitis and 2 of these remained free during the third lactation period. The third cow was removed from the herd at the end of the second lactation period.

Of the cases of mastitis which have occurred in this herd, only one has been acute and transitory in nature. The remaining cases have been chronic and for the most part of a mild type with a moderate increase in the number of leucocytes and catalase as the most prominent features, accompanied at times by an increase in the alkalinity and chlorine content of the milk. Three cows have developed frank cases of mastitis in one or more quarters. In one of these animals, streptococci appeared in one quarter at the beginning of the second lactation period where they remained during that and the succeeding period. This species, however, did not resemble *Streptococcus agalactiae*, the common cause of chronic streptococcic mastitis. The remaining cases of mastitis both of the mild and severe type, with two exceptions, appeared to be caused by the same kind of an organism, a micrococcus which has not been classified so far. The severity of

the mastitis produced by this agent seems to depend on both the length of time the organism has been in the affected quarter and the number of bacteria present in the milk.

During the course of investigations of mastitis in various herds of dairy cows in the vicinity of Washington, D. C., several species of streptococci have been encountered which, as far as is known, have not been described previously as being responsible for bovine mastitis. The type of disease produced by one of these species proved to be particularly severe in that 14 of the 15 cows carrying it were found to have marked physical cases of mastitis in the infected quarters.

POULTRY-DISEASE INVESTIGATIONS

Poultry-disease investigations included principally work on leukosis (fowl paralysis) and avian encephalomyelitis (epidemic tremor).

The work on leukosis consisted in studies on (1) artificial transmission, (2) genetic transmission, and (3) chick-embryo propagation. In the first-mentioned study an attempt is being made to produce a virus of more uniform potency with respect to number of takes and shortness of incubation period than has hitherto been attained. Transmission of the disease was accomplished by intraperitoneal or subcutaneous inoculation of blood from natural field cases of the disease into chicks a few days old. Takes occurred in 36 percent of chicks inoculated with leukotic tissues and in 26 percent of chicks inoculated with tissue filtrates.

Leukotic blood has been passaged serially 8 times through young chicks and of the 218 chicks inoculated, 52.7 percent developed leukosis. At the same time the incubation period, which averaged 80 days in the first passage, has been gradually lowered to an average of 31 days in the most recent passage.

In the genetic transmission of leukosis, 80 chicks from a flock in which there was a relatively high incidence (24 percent) of sporadic visceral leukosis (big liver disease) were reared in a leukosis-free environment and observed for more than 13 months. During this period, 7 cases of leukosis developed among the 80 chicks. A flock of 86 chicks of another breed, the progeny of a commercial flock in which there was a long history of leukosis of the iritic and visceral types, was reared free from any known leukosis contacts. During the year leukosis to the extent of 16 percent has occurred in this flock. A control flock of 57 birds was reared in an environment similar to that of the last-mentioned flock, and during a year 2 cases, or 3.5 percent, of leukosis occurred.

Investigations on avian encephalomyelitis were begun with the object of studying the relationship of the virus of this disease to similar mammalian neurotropic viruses. It seemed desirable first to increase its potency and uniformity. This is being attempted by chick-embryo and baby-chick propagation. Thus far about 100 chick embryos have been inoculated. Some success has been attained in this technique since 7 of 15 chicks inoculated with first- and second-passage embryo virus have succumbed to encephalomyelitis. Of 137 baby chicks inoculated with chick-brain virus, 54 percent developed encephalomyelitis. The incubation period averaged 25 days.

ANIMAL HUSBANDRY AND ANIMAL NUTRITION DIVISIONS

Animal-husbandry investigations were conducted by the Animal Husbandry Division under the direction of Hugh C. McPhee, Chief, and by the Animal Nutrition Division under the direction of Paul E. Howe, Chief. The work of the former Division consisted chiefly of research in livestock breeding and management, and that of the latter chiefly of research in livestock nutrition and feeding, including the chemistry of feeds and animal products. Because of the closely related nature of these fields of study, the work of the two divisions is reported jointly.

Cooperation was continued, through three extension representatives, with the Extension Service and State extension workers in the establishment and furtherance of livestock projects.

BREEDING AND FEEDING INVESTIGATIONS WITH SMALL ANIMALS

The breeding investigations with laboratory animals were materially changed. The size of the guinea-pig colony was greatly reduced, a colony of 11 inbred strains and 3 noninbred strains of mice having largely replaced it. These mice are being used to determine the effect of various systems of cross-breeding on reproduction, growth, and viability; to determine the extent of heterosis obtained from intercrossing and topcrossing inbred lines; and to study the effect of such systems of crossing on the uniformity of the descendants. Some of the strains show superiority over others in growth characteristics and fertility. These experiments supplement those under way at the regional laboratories with swine and sheep.

An analysis of the cross-breeding work with guinea pigs from 1916 through 1937 has been completed. Results of this study agree in many respects with those obtained in cross-breeding work with corn, some hybrids showing marked improvement over the parent strains and others no advantage.

In a search for superior germ plasm and to obtain data on the inheritance of intelligence and temperament in domestic animals, dogs have been used as the experimental material. The Puli has been crossed with three other breeds: The German Shepherd, Border Collie, and Chow Chow. A few back crosses have also been made between the first-generation animals and the parent stocks.

The wide variations in the scores made by the first-generation offspring of the various crosses indicate that there is a large degree of heterozygosity in the parent stocks for the characters being studied and that it will be possible to obtain improvement by recombination, or at least a much greater uniformity of the breeds for the desired characters.

Six tests have now been devised for measuring intelligence, temperament, and sheep-herding ability. Between 60 and 70 dogs have been used in these tests. They appear to be giving satisfactory results although it will require further data to establish their real value.

In studies on the nutritive requirements of animals and the properties of feedstuffs, improvement was made in the method of estimating the relatively indigestible portion of the carbohydrate complex of feedstuffs. A technique was developed for the determination of lignin, a component of feeds not digested to any great extent by

most livestock. In this technique, enzymatic digestion is first employed to remove the easily digestible starches and sugars and most of the protein, followed by chemical separation of the lignin fraction.

There has been a need for greater refinement in the biological technique for vitamin E assay of feedstuffs. In the case of fairly concentrated sources of this vitamin, investigators fed the material to be assayed either throughout the entire 21-day gestation period of female rats or in a single or limited number of portions during the first few days of the period. It was found that a minimum quantity was required when fed as a single dose early in the gestation period, for example, on the second day. Less concentrated sources of vitamin E sometimes must be fed for a period of several days. Delay in feeding until the seventh day resulted in a high proportion of resorptions, and a moderately large dose deferred until the twelfth day was of no benefit. It appears that the major benefit from the vitamin E factor in feedstuffs is obtained during the first half of the gestation period. The work further supports the suggestion of others that the total quantity fed early in gestation, which is just sufficient to permit birth of young, is a more accurate method of expressing vitamin E units than the daily quantity of test feed given over the entire gestation period.

A study was made of the influence, on the growth of young male rats, of feeding a vitamin E-deficient diet. Retardation of growth occurred at the fourteenth to sixteenth week in rats kept on the deficient diet from the age of 4 weeks. It was corrected when the animals were changed to a normal diet. Animals 8 and 12 weeks old when feeding of the deficient diet was begun did not show this retardation.

The high requirement for calcium and phosphorus as compared with that for other inorganic elements commonly supplied in mineral mixtures was shown in a study in which various levels of mineral mixtures were added to a simple ration of casein, yeast, dextrin, and cod-liver oil. It was found that the addition to the diet of a 1-percent mineral mixture allowed a very satisfactory rate of gain and good body storage of ash in rats. With an increase up to 3 percent in the mineral additions to the ration, there was a small but significant increase in rate of gain, efficiency of feed utilization, and ash content of the carcass. The addition of a 4-percent mineral mixture appeared to have the opposite effect except possibly in ash content. The mineral mixtures used in this work were generally richer in calcium than a number commonly used. The results indicate some advantage in keeping the mineral content of the diet at a low level if it at the same time meets the body requirements for the different elements, especially calcium.

To determine the feeding value of various grasses, with rats as the test animals, different varieties were incorporated with corn in such proportion that the grass furnished half of the protein in the diet and the corn the other half. All samples of grass were in the vegetative state. Orchard grass and redtop resulted in better growth of the rats than did Kentucky bluegrass and Canada bluegrass. Yellow corn alone gave better growth response than the combination of grass and corn, although the redtop and orchard grass fed with corn in a few instances resulted in nearly as good growth as that on corn

alone. In general, the rat was found to be reasonably satisfactory for use in this type of experiment as long as the grass was fairly high in protein, did not constitute more than a third of the total diet, and the crude-fiber content was reasonably constant.

MEAT INVESTIGATIONS

Meat investigations included both independent studies and cooperative work with the Bureaus of Agricultural Economics and Home Economics and 12 State experiment stations.

In the first year of a cooperative study with the Virginia Agricultural Experiment Station and the Virginia State Division of Markets, to compare the effects of grass and of grain feeding on the quantity and quality of beef, high-grade 3-year-old Hereford steers were fed to approximately the same degree of finish on bluegrass alone and on corn with cottonseed meal and mixed hay. The animals weighed approximately 900 pounds at the beginning of the experiment, were fed 168 days, and averaged more than 1,300 pounds each at the close of the feeding period. A comparison of the 2 groups showed no appreciable difference in dressing percentage, no difference in grade of carcasses, and a similar percentage of edible meat in the carcasses. Little difference was observed in palatability factors, after either 10 or 50 days of storage of the meat at a temperature of approximately 34° F. The fat of the grass-fed animals was slightly yellower and contained much more carotene, the chief source of vitamin A, than did the fat of the grain-fed cattle. In view of the discrimination often suffered on the market by beef from grass-fattened cattle, these results are of particular interest.

In research designed to establish more exactly the characteristics of the different official grades of cattle and beef, accumulated data on 87 Shorthorn steers were summarized. These cattle were fed and handled under uniform conditions and slaughtered in each case at a final weight of approximately 900 pounds. Choice, Good, and Medium grades of carcasses were represented. Tentative mean values were determined for a number of important factors for these three grades.

Analysis was made of accumulated data on 56 Shorthorn steers of dual-purpose type, representing 16 sires used in performance studies at Beltsville, Md. The steers, which averaged approximately 900 pounds in weight, varied considerably in their dressing percentage, percentage of edible meat, fatness, and proportions of the various carcass cuts. The results indicated opportunities for improvements in carcass and meat characteristics of this type of Shorthorn cattle.

In studies designed to establish superior strains of cattle, carried on at the United States Range Livestock Experiment Station, Miles City, Mont., in cooperation with the Montana Agricultural Experiment Station, data were obtained on the progeny of different Hereford bulls. These studies furnished further evidence that proportion and distribution of fat and proportion of muscle tissue, as well as tenderness, are affected by genetic factors. Three years' study of the progeny of two sires showed that one of the two bulls sired calves having more tender meat than those sired by the other bull.

Freezing was found to increase the tenderness of beef frozen at temperatures of 20°, −10°, and −40° F. as compared with that at a nonfreezing, control temperature of 34°, no period of storage being involved. Twelve percent less force was required to shear the samples frozen at 20° than those not frozen and 18 percent less to shear those frozen at −10° and −40° than the unfrozen samples. No significant difference was found between the samples frozen at the two lowest temperatures. In all cases the freezing was done in air without forced circulation.

Additional data were obtained on hothouse lambs sired by a Southdown ram and from Dorset × Delaine Merino ewes. These data substantiated last year's results that carcasses from lambs of this breeding were less fat and had a lower proportion of edible meat than those of Southdown-sired lambs from either Dorset or Dorset × Tasmanian Merino ewes. Moreover, they also had less eye muscle in the rib cut. There were no important differences among the three groups in percentage of weight of trimmed legs based on carcass weight. The carcasses of lambs from Dorset × Delaine Merino ewes, however, had the highest proportions of shoulder, loin, and neck cuts, the lowest proportion of breast, and an intermediate proportion of rib. Although of a high degree of tenderness, the roasted legs of all three crosses were somewhat low in juiciness.

At the Agricultural Research Center, lamb carcasses of a desirable degree of firmness, and meat with practically no difference in palatability, were produced on fattening rations of Mammoth Yellow soybeans with and without a supplement of corn, and on a standard ration of corn with cottonseed meal. Each group of lambs also received alfalfa hay. Considering the well-known softening effect of soybeans on the fat of hogs, this result with lambs, supplementing those of previous work, suggests a difference between sheep and hogs with respect to the digestion or metabolism, possibly both, of soybean fat.

In a cooperative study with the Wyoming Agricultural Experiment Station on the effect of breed of sire on quality of lamb meat, results of the third year's test were obtained. These data failed to corroborate previous results in that the meat of Lincoln × Rambouillet (first generation) lambs was not the least tender of the four first-generation crosses, Lincoln × Rambouillet, Corriedale × Rambouillet, Columbia × Rambouillet, and Romney × Rambouillet, studied. However, the meat of the Lincoln × Rambouillet (second generation) lambs was distinctly less tender than that of the other three second-generation crosses, and a summary of the 3 years' results indicates that lambs sired by the Lincoln rams used in the study produced meat lacking in tenderness.

Studies were continued, at the Agricultural Research Center, on the storage of frozen lamb rib cuts, consisting of the fourth to twelfth ribs. It was found that although cuts frozen and stored at 0° F. were satisfactory after 168 days in storage, there was a definite decrease in desirability when the cuts were held for 280 days. These results indicate that the turning point with such cuts frozen and stored at 0° is at some stage between approximately 6 and 9 months' storage. Until more definite information is obtained, it would seem

best not to store longer than 6 months at 0° if the most palatable meat is a primary objective.

For the purpose of determining the relationships between carcass measurements, on the one hand, and the quantities of fat, lean, and total edible meat, yields of cuts, and other factors, on the other hand, data on approximately 1,500 hogs have been accumulated. These animals varied widely in weight, breeding, type, and method of feeding. Considerable progress was made in the statistical analysis of these data. Results showed that the average thickness of back fat was the factor most closely related, in general, to the percentages, based on carcass weight, of the ham, bacon, loin, and cutting fat. Percentage of cutting fat was most closely related to average thickness of back fat. Weight of carcass per unit of length was one of the most consistent indexes of yields of the four cuts mentioned.

Cooperative work, involving various methods of feeding soybeans to swine, was carried on with the North Carolina Agricultural Experiment Station. Two groups of pigs with initial weights of approximately 40 pounds were fed rations containing 58.5 and 78.5 percent of soybeans for an average gain of 44 pounds and were then fed to a finished weight of 225 pounds on corn with cottonseed meal and other supplements. A group of similar pigs grazed ripened soybeans in the field until they gained 44 pounds and were then finished in the same manner. A control group received the corn ration throughout the growing and finishing periods. All groups except one produced carcasses that were hard when chilled. The group fed 78.5 percent of soybeans produced medium-hard carcasses.

Further research was carried on at the Agricultural Research Center on the characteristics of bacon from the Bureau's strains of Danish Landrace, Poland China, and Duroc-Jersey hogs. With respect to width in relation to length of lean streak in the cross-section cut of bacon, it was found that the breeds ranked in the order given. These results explain in part the differences, reported last year, in area of lean in the cross-section cut. Together with other results obtained by the Bureau, they indicate that the Landrace hogs have heavier, thicker muscles than the two American breeds with which they have been compared.

In a study of the yields of various cuts from carcasses of Danish Landrace, Duroc-Jersey, and certain crosses between the two breeds, the proportion of ham from the hogs containing 25 and 50 percent of Landrace blood exceeded that of either parent breed. Carcasses of hogs having 62.5 percent of Landrace blood produced approximately the same proportion of ham as did the purebred Landrace. As stated in previous reports, the Bureau's strain of Duroc-Jersey hogs produced less than did the Landrace. The proportion of bacon from the cross having 62.5 percent of Landrace blood exceeded that from the crosses having 25 or 50 percent, although it was somewhat less than that of either parent breed. The proportion of loin also was greater from the cross having 62.5 percent of Landrace blood than from either of the other two crosses as well as from the Duroc-Jerseys. In this characteristic, the purebred Landrace was superior to the cross with 62.5 percent of Landrace blood. In total yield of ham, bacon, and loin, this cross was superior to the Duroc-Jersey and

the other two crosses but did not equal the purebred Landrace. In thickness of back fat, there was little difference between the purebred Landrace and the cross with 62.5 percent of Landrace blood, both having a lower value in this respect than the Duroc-Jersey and the other two crosses.

In further cooperative work with the Maryland Agricultural Experiment Station, hams weighing approximately 15 pounds each were dry-cured 2 days per pound of weight and comparable hams were brine-cured 3 days per pound of weight. The curing mixture consisted of 8 pounds of common salt, 2 pounds of sugar, and 2 ounces of saltpeter per 100 pounds of meat. In the brine curing, enough water was added to give a solution with a salinometer reading of 73°. At the end of the curing period the hams contained from 3.5 to 4 percent of salt in the edible meat. During a storage period of 20 weeks, hams from both types of curing stored at 107° F. lost moisture more rapidly and contained a more even salt distribution throughout the muscles than similarly treated pair mates stored at 55°. The hams stored at the higher temperature had a much more pronounced aroma, deeper red color of lean, and an oily, translucent fat.

Periodic chemical examination of several fats stored for about 5½ years at 33° to 36° F. showed progressive rancidity. Samples were taken from some of these stored fats and incorporated into biscuits. The fats selected were a hydrogenated cottonseed oil, a hydrogenated lard, a kettle-rendered lard from corn-fed hogs, and a commercial prime steam lard. A fresh sample of leaf lard, obtained on the market, was used as a standard of comparison. A committee judging the biscuits for flavor and aroma found the hydrogenated cottonseed oil, the hydrogenated lard, and the control lard to be satisfactory. The commercial prime steam lard and the kettle-rendered lard from corn-fed hogs were considered undesirable.

Supplementing results reported last year, the Bureau determined that in general the free-fat-acid content of the fat of the lean tissue increased more rapidly than that of the fat tissue when pork loin cuts were frozen at 0° F. and then stored 282 days at 0° and 18°, both protected and unprotected from air. The free-fat-acid content of the lean from loins stored for this period at 18° was much higher than that from loins stored at 0°.

Studies on curing, smoking, and aging dressed turkeys were continued at Beltsville. Results indicate that a satisfactory salt content is obtained in turkeys cured at 38° F. for approximately 1¼ days per pound of dressed weight in a brine consisting of 6 pounds of common salt, 3 pounds of sugar, and 2 ounces of saltpeter with sufficient water to give a salinometer reading of 70°. Under these conditions the amount of nitrite present in the meat was found to be well within approved limits. Removing the leg tendons appeared to hasten salt penetration into the drumstick during the cure. Smoking the cured turkeys 16 hours at 140° produced a more desirable color than 20 hours of smoking at 110°. The higher smoking temperature resulted in more shrinkage during the aging process, but the losses during the smoking process were about the same at the two smoking temperatures.

The tentative method for determining the juice content of cooked meat, reported previously, was modified and improved. Technical

refinements in the press apparatus made possible virtually complete recovery of the expressed juice from any given sample.

In a study on the development of laboratory technique for measuring intensity of meat flavor, beef roasts were cooked to approximately 90° C. internal temperature at an oven temperature of 200°. The brown outside of the roasts was scraped carefully so that the scrapings included only the browned surface. These samples were dried, then defatted, and a nonprotein nitrogen determination was made. Samples of the inner portion of the roast were treated similarly. Results showed a higher nonprotein nitrogen content of the outside browned portion than of the inner portion of the roast, each on a moisture and fat-free basis. This finding indicates that high temperature brought about considerable change in the exposed surface of the meat and that the higher nonprotein nitrogen content may be associated with developed flavor.

BEEF AND DUAL-PURPOSE CATTLE INVESTIGATIONS

BREEDING INVESTIGATIONS

Record-of-performance investigations were carried on at 6 stations of the Bureau located at Beltsville, Md., Miles City, Mont., Jeanerette, La., Brooksville, Fla., Tifton, Ga., and Grain Valley, Mo. An analysis of the data accumulated for several years on 168 steer calves shows that their average gain was 16.43 pounds per 100 pounds of digestible nutrients fed, and the average carcass grade was average Good. Of the 25 sires of 6 beef and dual-purpose breeds on which there are enough data to indicate their breeding value, 8 sired calves whose average performance was above the average of the entire group and 17 sired calves whose average performance was below.

A study of birth weights of cattle indicates that differences between the weights of male and female calves are due, in part, to differences in gestation period for the two sexes. There is also a marked tendency for cows to have an individual characteristic for length of gestation period and birth weight of calves produced. Cows that tend to carry their calves overtime tend to have heavier calves. Variations in weight or condition of cows do not tend to affect the birth weight of the calves produced. Season has little influence on length of gestation or birth weights of calves. It was observed that cows giving birth to twin calves average a 6-day shorter gestation period than those giving birth to single calves.

At the Agricultural Research Center, four beef Shorthorn sires have completed progeny tests under the record-of-performance program. Two of these bulls have significantly higher total performance ratings than the average for all other bulls studied at the various stations, regardless of breed. Three of the bulls, however, sired calves whose efficiency of gain was below the average for all calves studied.

Eleven beef Shorthorn steers on record-of-performance test at Beltsville required 286 days on feed to reach 900 pounds of weight, with an average daily gain of 1.42 pounds; 10 Milking Shorthorn steers required 261 days to reach that weight, with an average daily gain of 1.51 pounds. The beef Shorthorn steers required 218 days

to reach a weaning weight of 500 pounds, as compared with 244 days for the Milking Shorthorns. The latter produced 14.1 pounds of gain for each 100 pounds of digestible nutrients consumed, and dressed 57.6 percent, as compared with 15.1 pounds of gain and a dressing percent of 57.9 for the beef Shorthorns.

Two Milking Shorthorn sires were proved at Beltsville for the production of beef and the ability to transmit high milk production. These are the first sires of this breed to be so tested. One sire has 18 daughters that have qualified for the record of merit for Milking Shorthorns. These 18 daughters have a total of 23 records averaging 7,887 pounds of milk and 308 pounds of butterfat. This bull has sired 15 steers that completed the record-of-performance test with an average daily gain of 1.55 pounds for the average feeding period of 247 days, dressed 56.7 percent, and had a carcass grade of Medium. This is the first Milking Shorthorn sire that has been progeny-tested for the production of both beef and milk.

Studies at the Iberia Livestock Experiment Farm, Jeanerette, La., on the relative efficiency of genetically different types of cattle to withstand heat were continued. Observations were made on the rates of respiration and of transpiration of water through the skin, nitrogen concentration of the urine, moisture content of the feces, and rectal temperatures. Results of these observations indicate that there are genetic differences in the response to high temperatures in the types studied. Except for moisture content of the feces, there were significant differences among types when shade temperatures exceeded 70° F. It was determined that the purebred Aberdeen Angus cattle and those with 75 percent of Angus blood are not so physiologically adapted to high temperatures, humidity, and intense sunlight of tropical and semitropical climates as are purebred Brahmans or those with 50 percent of Brahman blood.

In record-of-performance studies at Jeanerette, the average gain of purebred Aberdeen Angus steers was 12 pounds per 100 pounds of digestible nutrients. The second-generation Brahman × Angus was next to the Angus in efficiency of gain, followed in order by the first-generation Brahman × Angus, first-generation Africander × Angus, and the three-fourths Angus × one-fourth Brahman steers. In carcass studies the last-mentioned group and the purebred Aberdeen Angus graded the same (average Good), the half-bred Brahmans low Good, and the half-bred Africanders high Medium.

Record-of-performance studies of Hereford cattle were continued at the United States Range Livestock Experiment Station, Miles City, Mont., in cooperation with the Montana Agricultural Experiment Station. Three years' results of feeding progeny from 3 rather closely related bulls show definitely that the feeding of a large number of progeny is unnecessary in order to ascertain the breeding ability of beef bulls. At the close of the fiscal year a total of 62 calves from the 3 bulls had been fed out, but the ranking of the bulls and the average performance of their offspring have not changed materially since the first 5 to 10 calves from each bull finished test.

At the Chinsegut Hill Sanctuary, Brooksville, Fla., records of efficiency of milk production were completed on 10 mature and 5 young cows, chiefly of the Red Polled breed. The mature cows averaged

8,098 pounds of milk, 326.5 pounds of butterfat, and 26.1 pounds of digestible nutrients in the form of milk for each 100 pounds of digestible nutrients fed. The young cows, which were in their first lactation, produced 5,001 pounds of milk, 201 pounds of butterfat, and 19.7 pounds of digestible nutrients for each 100 pounds of nutrients fed. Observations on the muzzle color of crossbred Red Danish × Red Polled calves produced at this station show the dark muzzle of the Red Danish to be dominant to the flesh color of the Red Polled.

At Sni-a-Bar Farms, Grain Valley, Mo., in cooperation with the Missouri Agricultural Experiment Station, the breeding ability of three Shorthorn sires was tested. Three herds of breeding cows selected at random were bred to these unrelated bulls. The breeding herds were handled separately but under the same conditions, and their calves were fattened in separate groups under the same conditions. The progeny of one bull averaged 16.9 pounds of gain per 100 pounds of digestible nutrients as compared with 15.6 and 15.3 pounds for the progeny of the other two. In carcass quality the three lots of steers were about equal.

At the United States Morgan Horse Farm, Middlebury, Vt., eight Milking Shorthorn cows qualified for the record of merit. Their average production was 6,947 pounds of milk and 277 pounds of butterfat, with an average test of 3.97 percent. All records except one were made by heifers during their first lactation period. Cross-breeding work was continued at this station, a Red Danish sire being used with Milking Shorthorn females. During the year 13 calves were born from these matings. Twelve calves were red and one was roan in color. These crossbred calves weighed significantly more at birth than did the purebred Milking Shorthorn calves.

Experiments at different points in Florida in cooperation with the Florida Agricultural Experiment Station indicate that first-cross cows from purebred bulls show an improvement of 16 to 28 percent in conformation, based on their scores, over that of their native scrub dams. Calves sired by purebred bulls and out of scrub dams graded Medium to Good as slaughter calves, on the average.

FEEDING INVESTIGATIONS

Mineral-deficiency studies conducted in cooperation with the Texas Agricultural Experiment Station and the King Ranch near Falfurrias, Tex., are now in their second year. This experiment is designed to correct phosphorus deficiencies which have been shown to exist throughout the Gulf coast area. As stated in last year's report, analyses of grass samples indicate a sufficiency of calcium and a serious deficiency of phosphorus. Three groups of 2-year-old heifers on range are being fed mineral supplements, one group receiving bonemeal, another disodium phosphate, and the third bonemeal with small quantities of iron, manganese, copper, boron, cobalt, and zinc salts. The quantities fed to the first two groups provide a daily allowance of 6.5 grams of phosphorus per head for the dry heifers and 14.3 grams for those nursing calves. In the group receiving a number of mineral salts, however, the phosphorus is fed at the rate of 6.5 grams daily per head to both the dry heifers and those nursing calves. A fourth group receives no mineral supplement. At the end of the fiscal year,

the inorganic phosphorus levels in the blood of the three mineral-fed groups were decidedly higher than those in the control group, with a slight advantage in favor of the groups receiving bonemeal and mineral salts and bonemeal alone. The inorganic phosphorus level of the control group was somewhat lower than at the beginning of the experiment. There has been little change in hemoglobin levels in the blood. Among the calves born in the different groups, there appeared to be no significant difference in phosphorus and hemoglobin levels, although the calves from heifers receiving no mineral supplement on the range had somewhat less phosphorus and hemoglobin per 100 cubic centimeters of blood than those in the other groups. In the 18 months that this experiment had been carried on, the cows that received mineral supplements in addition to the native range were approximately 100 pounds heavier than the control cows. The calves from the cows receiving phosphorus, although weighing no more at birth than those from the control cows, gained significantly more rapidly.

The third year's experiment at Big Spring, Tex., in cooperation with the Bureau of Plant Industry and the Texas Agricultural Experiment Station, showed that greater gains and higher carcass grades were made by steers full-fed ground threshed milo in a group than by steers full-fed individually or by those fed 80 percent as much milo individually or in a group. The steers receiving limited quantities of milo made more efficient use of the feed than did the full-fed steers. However, the latter steers fed as a group returned the greatest net profit, as the increased finish and gains of these steers enhanced their value sufficiently to more than offset their increased cost of gains.

In vitamin A-deficiency studies at Spur, Tex., in cooperation with the Texas station, the year's results indicated that night blindness, resulting from that deficiency, occurred with the daily feeding of 2,500 micrograms of carotene per 100 pounds of live weight. There were indications, however, that the critical level was somewhat lower than this. Although it has been reported that urinary calculi are associated with a deficiency of vitamin A, the animals used in these studies were practically free from them.

A steer-feeding experiment was carried on at Tifton, Ga., in cooperation with the Georgia Coastal Plain Experiment Station and the Georgia Experiment Station, to determine the effect of grade of steer on efficiency in feed utilization. A group of Good steers and a group consisting of an equal number of Medium and Plain steers were fed a standard ration, based on average initial live weights of the animals. At the end of 84 days, 15 random-selected steers in each group were slaughtered, and an equal number were continued on feed 56 additional days. The quantity of feed given to the Good steers during the additional feeding period was regulated by the quantity consumed by those in the other group, but was proportionate to their respective average live weights. At the end of the 84-day feeding period, the Good steers gained 21.9 percent a head more than the others and had used their feed somewhat more efficiently. For the 140-day feeding period, the Good steers were slightly more efficient in feed utilization, although during the last 56 days of the experiment the inferior steers were slightly more efficient. The Medium

and Plain steers returned slightly more per dollar of expense than the Good steers.

At the same station the substituting of molasses for one-fourth of the corn in fattening rations for steers gave more satisfactory results than did the substituting of molasses for one-half of the corn, but gave less favorable returns than a ration of ground corn, velvetbeans, and peanut hay. These results are in agreement with those of the previous year.

In cooperation with the North Carolina Agricultural Experiment Station at Raleigh, N. C., a study was continued with paired yearling cattle, one of each pair being fed lespedeza hay and the other a limited ration of shelled white corn and lespedeza hay. Both animals of each pair were slaughtered when the grain-fed individual attained a weight of 1,000 pounds. The grain-fed steers made an average gain of 236 pounds, or 1.74 pounds daily, on an average ration of 11.5 pounds of corn and 10.1 pounds of hay. Those receiving only lespedeza hay made an average gain of 102 pounds, or 0.75 pound daily, on an average ration of 19.1 pounds of the hay. These results are in agreement with those of last year.

In an experiment at Blacksburg, Va., in cooperation with the Virginia Agricultural Experiment Station, the Virginia Department of Agriculture, and the United States Bureau of Agricultural Economics, 3-year-old steers were fattened on grass alone and on grain in the feed lot so as to make similar gains. When the animals were marketed, there were no significant differences between the two groups in dressing percent and in carcass grade, in spite of the fact that the packers paid $1 per hundredweight more for the grain-finished cattle. As the feed cost for these cattle was more than twice that for the grass-fattened cattle, the increased sales price did not offset the increased feed cost of the grain-fattened steers.

At Beltsville, investigations on nutritional diseases of cattle and methods of detecting and correcting them were continued. Special attention is being given to vitamin A deficiency and other factors contributing to disorders of the reproductive and urinary systems of cattle. Beef heifers were largely depleted of carotene and vitamin A, with the result that clinical symptoms of vitamin A deficiency began to appear. Early symptoms were detected by examination of the eyes of the animals with the aid of an ophthalmoscope. Early deficiency can be detected by this means before marked night blindness or other advanced symptoms are evident. Changes in the eyes of animals which developed during the depletion period largely persisted even though sufficient vitamin A was later fed to overcome other clinical symptoms of vitamin A deficiency. Preliminary findings show that most animals begin to manifest early symptoms of vitamin A deficiency when the carotene content of the blood plasma has decreased to 25 micrograms or less per 100 cubic centimeters and when the vitamin A content is 16 micrograms or less per 100 cubic centimeters in the same sample of plasma, as determined by the spectrophotometric method.

PASTURE AND RANGE-UTILIZATION INVESTIGATIONS

At the Ardmore Field Station, Ardmore, S. Dak., experiments comparing alternate and continuous methods of grazing native range with

yearling steers were continued for the second year. The first year's results have shown that approximately 20 acres of native range, consisting largely of western wheatgrass, buffalo grass, and blue grama, was sufficient to carry a yearling steer for the entire year, exclusive of short periods of very inclement weather when it was necessary to feed a supplement of hay and grain in small quantities. Results for the 2 years indicate no advantage in alternating the grazing from one-half of the area to the other every 28 days. In either alternate or continuous grazing, the yearly gains per steer averaged approximately 320 pounds for the 2 years. During the first year, the steers continuously grazed made slightly greater daily gains, whereas during the second year those alternately grazed gained more rapidly. In the first year the steers were sufficiently finished to sell as slaughter cattle, but last year they sold as feeders.

At the United States Range Livestock Experiment Station, Miles City, Mont., a grazing experiment was carried on for the fifth year in cooperation with the Forest Service and the Montana Agricultural Experiment Station to determine the effect of rate of stocking on calf production. Lightly grazed pastures, stocked at the rate of 38.8 acres per cow for 12 months, produced 401 pounds of calf per cow. Moderately grazed pastures, stocked at the rate of 30.5 acres per cow, produced 404 pounds of calf per cow. Overgrazed pastures, stocked at the rate of 23.1 acres per cow, produced 364 pounds of calf per cow. Cows on moderately grazed pastures had the highest, and cows on overgrazed pastures the lowest percentage of calf crop during the year.

At Sni-a-Bar Farms, Grain Valley, Mo., experimental work was continued in cooperation with the Bureau of Plant Industry and the Missouri Agricultural Experiment Station for the purpose of comparing different systems of grazing yearling steers. This study again showed a considerable advantage in supplementing bluegrass pasture with Korean lespedeza for a period of approximately 7 weeks during the middle of the summer, when bluegrass pastures are usually at their lowest carrying capacity.

At the Coastal Experiment Station, Summerville, S. C., in cooperation with the South Carolina Agricultural Experiment Station, grazing experiments were continued for the third year to compare the beef-producing capacities of permanent pastures receiving different mineral treatments. On the average, for the 3 years, greatest beef returns per acre were obtained from the carpet grass and lespedeza pasture fertilized with 1,500 pounds of basic slag every third year. The next highest returns were from carpet grass and lespedeza fertilized with 2,000 pounds of lime every third year and 250 pounds of superphosphate annually. The average gains per acre were 59.3 pounds with the former method and 56.6 pounds with the latter. Steers on a third pasture consisting of carpet grass and lespedeza treated with 2,000 pounds of lime every third year made an average gain of 29.83 pounds per acre, and animals on carpet grass and lespedeza and on native broomsedge without fertilizer treatment produced 14.8 and 4.3 pounds of beef per acre, respectively.

Grazing experiments with different fertilizer treatments of the pastures at Tifton, Ga., in cooperation with the Bureau of Plant In-

dustry, the Georgia Coastal Plain Experiment Station, and the Georgia Experiment Station, were continued. Phosphate and potash fertilizers were applied every third year, and the nitrogen fertilizer was applied annually in two applications in the spring and early in the summer. A mixture of carpet grass, Dallis grass, lespedeza, and white clover on lowland permanent pasture, receiving 600 pounds of a complete fertilizer (6–12–6) under the system and grazed at the rate of slightly less than two steers to the acre, resulted in greatest gains per acre. The steers on this pasture gained 326 pounds per acre during a period of 224 days, whereas steers on a similar pasture treated with 600 pounds of fertilizer containing only nitrogen and phosphorus (6–12–0), gained 298 pounds during the same period. Bermuda grass and lespedeza upland pasture, fertilized with 600 pounds of complete fertilizer, produced 116 pounds of beef per acre when grazed at the rate of a little less than one steer per acre. Less than 100 pounds of gain per acre was obtained from each of three pastures, consisting respectively of *Paspalum malacophyllum* (not fertilized), carpet grass (not fertilized), and a mixture of carpet grass, Dallis grass, and lespedeza, fertilized with muriate of potash alone at the rate of 600 pounds per acre of the formula, 0–0–6, every third year.

At the Iberia Livestock Experiment Farm, Jeanerette, La., in cooperation with the Bureau of Plant Industry, grazing experiments have been undertaken to study the productivity of pastures and maintenance requirements of mature beef steers on pasture. Pastures are stocked as close to capacity as possible with the object of keeping the steers at their initial weight. For the first 84 days, the pastures produced 46 percent more steer days of grazing than the corresponding period of the previous year, when the pastures were grazed for maximum gains. Similar steers kept in a dry lot and fed 44 pounds of freshly cut grass per head daily maintained their weight during the spring months.

In grazing experiments at Chinsegut Hill Sanctuary, Brooksville, Fla., in cooperation with the Bureau of Plant Industry, 11 groups of steers were pastured on various kinds of grasses on cut-over sand-hill land. From June 14 to November 1, 1938, the grasses ranked in the following order for the quantity of beef produced per acre: (1) Cogon grass (from Philippines) and *Panicum repens*, with Cogon grass predominating; (2) Guinea grass (from Cuba); (3) centipede grass (from China) 80 percent and Napier grass 20 percent; (4) a mixture of four grasses with carpet grass predominating (fertilized); (5) Bahia grass (from West Indies); (6) a mixture of four grasses with carpet grass predominating (unfertilized); (7) wooly finger grass (from South Africa); (8) native grasses, with one-fourth of area in mixed carpet and Bahia grasses; (9) native grasses, unburned; (10) native grasses, burned annually; (11) centipede grass.

SHEEP, GOAT, AND ANIMAL-FIBER INVESTIGATIONS

Investigations in sheep and goat husbandry and animal-fiber technology were conducted at 6 Federal stations and at farms and laboratories involving the cooperation of 18 State experiment stations.

SHEEP-BREEDING INVESTIGATIONS

At the Western Sheep Breeding Laboratory at Dubois, Idaho, 1,327 Rambouillet ewes were divided into 60 breeding flocks, each of which was mated with a single Rambouillet ram. Of these 60 flocks, 14 were used in inbreeding experiments; 1 was used in the development of a strain having fleeces choice in length of staple; the purpose of another was to study the fixing of excellence in mutton form; the mating of 1 flock was designed for the establishment of a strain of Rambouillets with open faces; 1 flock was devoted to the study of inheritance of defective jaws; 6 flocks were outcrossed in search of combinations of meritorious characteristics; and 36 flocks were used in testing rams to discover meritorious sires.

The last two groups involve experiments which necessarily will require a number of years. In the other groups, results obtained during the year were briefly as follows.

The inbreeding studies indicate the possibility of obtaining offspring, averaging at least 30 percent inbred for the flock, which represent great improvement in uniformity of type, together with excellence in mutton conformation and fleece characteristics, and increased reliability in breeding true to type.

In the flock bred for long-staple fleeces, the weanling offspring had fleeces averaging about 20 percent longer in staple than the average for all the Rambouillet weanling lambs produced at the laboratory. As yearlings, the advantage of the ewes bred for long staple was 14 percent and of the rams thus bred, 25.6 percent, over the average for all the yearlings in the Rambouillet flock. Furthermore, the unscoured fleeces of the yearling ewes bred for this characteristic were 5 percent heavier and of the yearling rams, 10 percent heavier, than the average for all the Rambouillet ewe and ram yearlings, respectively, in the flock.

In the flock bred for choice mutton form, the yearling ewes averaged 4.4 percent heavier in body weight than the average for all the yearling Rambouillet ewes at the laboratory. The yearling rams born in this flock were 1.6 percent heavier than all the Rambouillet rams of this age that were retained.

In the flock bred for open faces, the faces of the ram lambs were, on the average, 75.3 percent bare or entirely free from wool blindness, whereas the faces of all the Rambouillet ram lambs at the laboratory averaged only 60.8 percent bare, with some faces sufficiently heavy in wool covering to cause some trouble with wool blindness. These figures indicate the progress being made in this genetic program to develop Rambouillet sheep that are free from too much wool over their faces.

The ram-lamb offspring from the Rambouillet ewes and rams having defective jaws all had overshot jaws to some degree. It is, therefore, apparent that this type of defect has a genetic basis.

Records of reproduction for nearly 8,000 matings of range sheep have been analyzed at Dubois. Sterility of rams was rare and low fertility was uncommon. The proportion of the ewes producing lambs was higher for the Corriedales and Targhees than for Columbias and Rambouillets. The lambing percentage was unaffected by variations in the condition of flesh of the ewes under range con-

ditions during the breeding season and was only slightly reduced by increasing the number of ewes per ram. However, it was definitely reduced by shortening the breeding season and by allowing the rams to run with the ewes only a part of each day. Fecundity, as measured by the percentage of lambs born from ewes lambing at the close of a full gestation period, was highest for Targhees, followed by Columbias, Rambouillets, and Corriedales in the order named. There was a definite increase in fecundity with advancing age of the ewes up to 5 years, which was also true of percentage of ewes lambing and percentage of live lambs born per ewe bred. Fecundity was directly correlated with gains and losses in the weights of the ewes during the breeding season. The rate of reproduction for all matings was 95 live lambs born per 100 ewes bred.

At Dubois a comparison was made of 3 methods of collecting ram semen. These were (1) from the vagina of a ewe after natural or forced mating, (2) with the use of an artificial vagina, and (3) by electrical stimulation of ejaculation. All methods were used on one ram, and the semen collected was tested by artificial insemination. The results show that semen collected by electrical stimulation had a greater volume and lower concentration of spermatozoa than the semen collected by the other 2 methods. Collection with the artificial vagina gave greater opportunity for temperature shocks, and fewer pregnancies resulted from semen collected by this method than from the semen collected from the ewe. From 10 ewes inseminated with semen collected from the ewe, 8 pregnancies resulted; whereas from 9 ewes inseminated with semen collected with the artificial vagina, only 3 pregnancies resulted, and from 10 ewes inseminated with semen collected by electrical stimulation, no pregnancies resulted.

At Dubois, an attempt was made to collect semen from 6 ram lambs at the age of about 4 months. Some of these lambs had been mounting ewes. Only small quantities of watery semen were obtained from 2 of the lambs, and no spermatozoa were found. Of 18 ram lambs given semen tests at 6 months of age, only 2 produced an appreciable number of spermatozoa. These 2 lambs were used in breeding pens for part of the breeding season, but no offspring resulted. Of 6 purchased rams tested for semen at about 7 months of age, 4 showed possible reproductive ability. Two of these sired normal numbers of lambs but the other two failed to sire any. About 20 ram lambs were given semen tests at 7½ to 9½ months of age, the greater number of semen collections being obtained at the latter age. There were 9 lambs from which services were obtained at 9½ months of age. When they were again tested at 10½ months of age, an improvement in the quality of their semen was found, but the reproductive ability of these rams was still low.

In the fall of 1938, shipments of semen from 2 Corriedale rams were made from Dubois, Idaho, to Beltsville, Md., and semen from 3 Rambouillet and 2 Lincoln rams was shipped from Dubois to Moscow, Idaho. Shipment of semen from 2 Corriedale rams also was made from Beltsville to Dubois. Ewes were artificially inseminated at 53 heat periods at Beltsville, at 56 at Moscow, and at 53 at Dubois. At Beltsville, 13 ewes became pregnant and produced 16 lambs; at Moscow, 8 ewes produced 9 lambs; and at Dubois, 1 ewe produced 1 lamb. Fourteen percent of the inseminations resulted in pregnancies.

These findings indicate that limited success may be expected from artificial insemination of ewes after storage of the semen. In summarizing the studies of the Bureau and those in cooperation with the Idaho station since 1936 on artificial insemination, it was found that a total of 309 inseminations had been made with ram semen. The semen was shipped by airplane for distances of 700 to 2,600 miles and stored for periods of 22 to 200 hours, with 31 inseminations resulting in pregnancies.

In a study of the duration of pregnancy in range ewes at Dubois, analysis was made of 658 gestation periods in Rambouillet ewes for the 1937–38 season. The duration of pregnancy ranged from 142 to 159 days with an average of 151 days. Preliminary results indicate that ewes carrying twins have a shorter duration of pregnancy than those carrying single lambs. Ewes lambing early in the season had shorter durations of pregnancy than ewes lambing late. As the duration of pregnancy increased, birth weight of the lambs increased also.

Studies with Karakul sheep at Beltsville have included the development of measurement standards for fur quality that can be applied directly to the day-old lambs, since it is at this time that decisions on the selection of breeding animals are made. Record-card forms have been developed that carry all the observations on the lamb. From a large number of accumulated cured pelts, standard judging sets have been selected, and from the raw pelts a luster series has been prepared. These standards, in conjunction with the previously collected judging sets, give a basis on which the get of rams may be compared. Also, a method of diagramming the extent of desirable and undesirable areas on the lamb was developed, giving permanent records of pattern tendencies. The grading-up from Black-faced Highlands and Corriedales was continued and furnished additional evidence that the fourth to sixth top crosses are necessary to reach the quality level of purebred Karakuls. These results further indicate that the desirable fur qualities in Karakuls are largely based on complex genetic characters. The studies were conducted in cooperation with the Bureau of Biological Survey.

The occurrence of oestrus in ewes at Beltsville was studied. Approximately 50 percent of ewe lambs of the Karakul, Corriedale, Shropshire, Hampshire, and Southdown breeds showed oestrus at 9 to 12 months of age with recurrence of heat one to three times. Mature Karakul ewes were found not to return to heat after lambing until the regular fall breeding season. Ewes of the Dorset, Corriedale, Dorset × Merino, and Tasmanian Merino types used in hothouse-lamb production at Middlebury, Vt., during the last 6 years were found to have a definite anoestrus period usually beginning in May and extending through June and July.

At the Southwestern Range and Sheep Breeding Laboratory, Fort Wingate, N. Mex., the results from the cross-breeding of Navajo ewes to improved rams indicate that the fleeces of the offspring from Romney rams are generally superior to those from Rambouillet, Corriedale, or Columbia rams as wool for the Indian handicrafts in the making of rugs and blankets. A thorough test of the fleeces of progeny from Romney rams and Navajo ewes is under way.

At Quincy, Fla., in cooperation with the Florida station, the improvement of native Florida sheep by the use of Columbia rams

is encouraging. The work has reached the stage of testing the second-generation offspring. These were the result of mating first-generation rams and ewes, no backcrossing being practiced. Many of these second-generation lambs weighed about 75 to 80 pounds at weaning time, and as yearlings the ewes produced fleeces of good wool weighing about 10 pounds unscoured. A yearling purebred Columbia ram born and raised at Quincy produced a good fleece of wool weighing about 25 pounds.

At Sonora, Tex., in cooperation with the Texas station, a study is being made of the inheritance of skin folds on Rambouillet sheep. The fine-wool breeds have predominated on the sheep ranges in Texas since the inception of the sheep industry in that State. In recent years the sheep industry there has been transformed to a mutton and wool basis, and the Rambouillet, owing to its larger size and more desirable mutton qualities, has come into favor on the range and has to a large extent replaced the Merino. There is considerable variation in the occurrence of skin folds on Rambouillet sheep, and dense-fleeced, smooth-bodied animals free from excessive skin wrinkles are in demand for both breeding and feeding purposes. The smooth-bodied type is also more resistant to blowfly infestation. Results of this cooperative project also show that the smooth-type Rambouillets produce wool of longer staple and of more uniform fiber fineness than the heavily wrinkled Rambouillets. The unscoured fleeces of the wrinkled sheep are heavier than those of the smooth sheep, but on a clean-wool basis the fleeces of the two types weigh about the same and they average about the same in fineness of fiber. Progeny tests indicate that there is some dominance of genes for freedom from skin folds and that the number of genes may be relatively small.

A study of factors that should be considered in the progeny-testing of rams has been completed. Data on body weight, fleece weight, and fleece length from 762 Columbia, 709 Corriedale, and 764 Rambouillet yearling ewes, born during 1925 to 1936 inclusive, were used in this study. These animals were raised under range conditions at the sheep station at Dubois. The analysis brought out the following points: (1) Seasonal variations in the characters studied are rather marked; (2) correlations between dams and daughters within years ranged from -0.04 to $+0.55$, all correlations but 1 being positive; (3) in the population studied, which consisted of the progeny of rams from which at least 20 female offspring had been retained for breeding purposes, significant differences between rams were demonstrated in 20 of the 72 comparisons made.

The findings indicate that differences among rams can be demonstrated even in groups in which selection has eliminated the poorer offspring of all rams, and from which only the better rams, as judged by the numbers of offspring retained for breeding, have been used in the analysis. The findings also indicate the desirability of basing comparisons of rams on progeny reared within a season, or else making adequate adjustments for differences in season. The relationships found between dams and daughters show the desirability of either mating all rams being tested to comparable groups of ewes, or adjusting data obtained on the offspring for differences due to dams.

SHEEP-FEEDING, GRAZING, AND MANAGEMENT INVESTIGATIONS

At Beltsville, high levels of soybeans in the fattening ration of lambs have given satisfactory results both in feed value and in effect on the meat. In a test, concluded during the year, the lambs were fed in three lots at levels adjusted weekly to produce approximately equal gains in live weight. All three lots received equal quantities of alfalfa hay. One lot received a grain ration of 6 parts of corn and 1 part of cottonseed meal; the second, equal parts of yellow corn and Mammoth Yellow soybeans; and the third, the Mammoth Yellow soybeans. Lots 1 and 3 made nearly equal gains on equal quantities of feed. The corn and soybean mixture of lot 2 was somewhat more efficient than the other grain diets and was consumed with greater relish than the soybean diet of lot 3. All three lots gained slightly faster than one-third of a pound a day per head during the 70-day period, and the meat was of approximately the same fat content.

At Newell, S. Dak., feeding experiments in cooperation with the Bureau of Plant Industry and the South Dakota station were continued with about 700 white-faced range lambs, divided into 7 lots of 100 lambs each, to study rations including corn, barley, alfalfa hay, corn silage, pressed beet pulp, beet tops, molasses, and bonemeal. All lots were fed good alfalfa hay. The ration producing the most profitable gains consisted of shelled corn, pressed beet pulp, beet tops, and alfalfa hay. No appreciable advantage resulted from the feeding of bonemeal. Adding sugar-beet byproducts to the ration of corn and alfalfa hay increased the profits.

At Miles City, in cooperation with the Forest Service and the Montana station, the results from the study of different rates of stocking sheep on the range of the northern Great Plains are pointing toward more effective and economical sheep grazing. Comparisons were made on the basis of a "forage acre," a term signifying an acre of range on which there is a full stand of forage. The data indicate that 0.1 forage acre per sheep per month is not sufficient and that 0 3 forage acre may be more than is required. Comparisons of 0.15, 0.20, and 0.25 forage acre per sheep per month are also being made.

At Beltsville results of studies in the use of temporary pasture crops for sheep showed that mixed seedings (equal parts by measure) of wheat, rye, and barley furnish excellent pasture for late fall and especially early spring use. One field sown to this mixture yielded 459 sheep-days of feed per acre. Areas sown to peas and oats (equal parts by measure) yielded 356, and those sown to soybeans 345 sheep-days of feed per acre. Both of these pastures have proved to be dependable for late spring and summer grazing.

A varying number of lambs in the Beltsville flock have become unthrifty during the hot summer months in spite of abundant pastures, grain feeding, and measures to control internal parasites. Rather heavy death losses occurred among the lambs during the summer of 1938. Autopsies and blood examinations of affected animals indicated that many of them were markedly anemic. Drenching affected animals with iron salts was followed by improvement in the blood, increased appetite, and resumption of growth. These preliminary findings suggest that nutritional factors may be involved in this condition.

MILK-GOAT INVESTIGATIONS

The breeding lines of Saanen and Toggenburg milk goats at Beltsville were studied for the occurrence of hermaphroditism, and evidence was found that this character behaves as a recessive. Since 1925 the Saanens have produced 11.1 percent of hermaphrodites and the Toggenburgs, 6 percent. In the Saanens, about 9.5 percent of the young born as singles or twins were hermaphrodites, whereas 15 percent of the triplets were so constituted. In the Toggenburgs, 10 percent of the singles were hermaphrodites, whereas only 4 and 6 percent of the twins and triplets, respectively, were similarly constituted. In the Saanen herd, 56.9 percent were born as twins; in the Toggenburg herd, 65 percent. Almost twice as many triplets as singles were born in the Saanen herd, whereas the proportion of each in the Toggenburg was about equal. No significant relation was found between type of birth and hermaphroditism.

At Beltsville, experiments were initiated to compare the effect of grain and different types of pastures on the production of milk and the maintenance of the health of goats. A group of approximately 25 does of the Saanen and Toggenburg breeds is being pastured on natural browse and a similar group on cultivated or temporary pasture crops. Each group of does is divided into 2 lots, 1 of which receives grain and the other no grain. Preliminary observations indicate a higher milk production in the grain-fed groups. For some years death losses have been higher among adult milk goats at Beltsville during the summer pasture season than at any other time of the year. In these experiments, fewer deaths have occurred among animals pastured on natural browse than among those on the temporary or cultivated crops.

At Beltsville malnutrition was suspected as a factor causing a health disorder in the milking herd of does. Accordingly, a study of the relation of diet to health and milking performance was undertaken. Low hemoglobin values and red-cell counts of blood have suggested that a form of anemia is involved. In other studies, chemical and immunological tests showed that newborn kids absorb a foreign protein such as egg albumin in such quantities as to produce fatal results when this protein is fed during the first 24 hours after birth. This finding is contrary to a popular belief that such a protein can be used as a substitute for colostrum.

ANIMAL-FIBER INVESTIGATIONS

More intensive investigations on the fur of Karakul lambs and other fur-bearing animals have been made possible through cooperation with the Bureau of Biological Survey, now in the Department of the Interior. In the study of the structural characteristics of these fibers, existing technique and methods for their examination are being improved and new ones are being developed. A method for quickly obtaining positive impressions throughout their entire length has been developed. The method makes it possible to see clearly defined the shape and arrangement of the scaly surface of fibers from one end to the other.

At Dubois, to compare the fleeces of weanling lambs with those of the same animals at 1 year of age, fleeces of about 200 Rambouillet, Corriedale, and Columbia ewe lambs at weaning age, and again at 1 year

of age, were studied for length of staple, weight of clean wool, density, and fineness. Definite correlations were found between the fleeces of the same animal with respect to length of staple, weight of clean wool, and fineness of fleece. With respect to density of fleece, however, the correlation was rather low.

At Fort Wingate, N. Mex., in cooperation with the Bureau of Indian Affairs, Department of the Interior, analyses were made of the fleeces of several hundred sheep used in the breeding investigations there, and also of fibers from famous old Indian rugs and blankets. It was found that the characteristics of wool fibers in the rugs and blankets of highest quality closely resembled certain characteristics in the wool fibers of fleeces of the Romney breed. New rugs made from such wool at the Fort Wingate wool laboratory by Navajo Indian weavers give further evidence that wool of the Romney type is the best that has yet been found for the Indian handicrafts in the making of rugs and blankets.

At Dubois, in cooperation with the Agricultural Marketing Service (formerly part of the Bureau of Agricultural Economics), wools have been obtained from Rambouillet, Corriedale, Columbia, and Targhee sheep for studies of clean-wool yields. Ninety-nine fleeces were sampled by the usual Bureau of Animal Industry method for studying yields of fleeces from sheep in breeding experiments, which method consists in shearing a small sample of wool weighing, unscoured, from 15 to 45 grams, from the middle of the side of the fleece before the entire fleece is sheared. Results on the clean-wool yield of these fleeces were compared with the results obtained by the Agricultural Marketing Service in its wool laboratory at Washington, D. C. The average yields from the small samples corresponded closely with those of the entire fleeces as determined by the Agricultural Marketing Service, the small samples yielding 39.91 percent of clean dry wool and the entire fleeces 38.57 percent. Of the 99 fleeces in this test, 67 had slightly less clean wool and 32 had slightly more than was determined by scouring the small samples. These results indicate that the samples may be depended on to furnish scouring data of sufficient accuracy to use in sheep-breeding experiments involving improvement of the fleeces for yields of clean wool.

SWINE INVESTIGATIONS

BREEDING INVESTIGATIONS

Representatives of the Chester White, Danish Landrace, Danish Yorkshire, Duroc-Jersey, Large Black, and Poland China breeds were used at the Agricultural Research Center in studies on problems of breeding, feeding, and management of swine. During the year, 178 litters were farrowed, 106 in the spring and 72 in the fall. All litters were weaned at 56 days of age, except those of the Poland Chinas, which were weaned at 70 days. The average number of pigs born per litter was 9.6, and approximately 98 percent of the 1,705 pigs farrowed were born alive. The number of pigs weaned per litter was 7.1, or 75.5 percent of those born alive. These results, compared with those of previous years, show a marked improvement in the proportion of pigs born alive and pigs raised to weaning.

Studies conducted at Beltsville and at the United States Range Livestock Experiment Station, in cooperation with the Montana station, for the purpose of developing superior strains of swine con-

tinued to show that strains possessing some of the better qualities of the Landrace and of other breeds tested may be developed by crossbreeding. In crosses involving the Landrace × Poland China, for example, 15 litters obtained from inter se matings of pigs produced by 2 generations of alternate backcrosses, averaged approximately 29 percent more pigs at weaning than the 15 Poland China litters farrowed in the same season, and excelled the 22 Landrace litters by about 7 percent in average weight per pig at weaning. Similarly favorable results were obtained for litters from various crosses involving the Landrace × Duroc-Jersey and Landrace × Large Black. In the Landrace × Hampshire crosses, 11 litters produced from matings of the first-generation offspring with the Landrace averaged 11 pigs at birth and 8.7 at weaning, and 11 litters from matings of the first-generation offspring with the Hampshire had an average of 8.6 pigs at birth and 8.4 at weaning. The respective average weaning weights per pig were 27.4 and 29.1 pounds.

At Beltsville, Duroc-Jersey×Yorkshire crosses again showed noteworthy performance. Two Yorkshire sows mated to a Duroc-Jersey boar averaged 14.5 pigs at birth and 10 at weaning. When fed from weaning to 225 pounds of live weight, the two litters averaged 1.42 pounds of daily gain per pig and required 350 pounds of feed per 100 pounds of gain.

Studies at Beltsville to determine the effects of inbreeding on fertility and growth and on efficiency of feed utilization have led to the establishment of a four-sire herd of Danish Landrace breeding and a three-sire herd of Chester White. Selection is being based on progeny tests and other methods likely to increase the effectiveness of selection. The percentage of inbreeding of the 22 Landrace and 15 Chester White litters farrowed in 1938 ranged from 0 to 14.5 for the former and 13.7 to 66.8 for the latter. The average percentage of inbreeding was 5.1 for the Landrace and 31.5 for the Chester White. Eighteen of these Landrace litters, when fed to a market weight of 225 pounds in record-of-performance trials, ranged from 1.08 to 1.62 pounds in average daily gain per pig and from 332 to 397 pounds in feed requirements per 100 pounds of gain. For 11 of the inbred Chester White litters fed under similar conditions, the average daily gain per pig ranged from 1.13 to 1.35 pounds and the feed requirements from 350 to 427 pounds per 100 pounds of gain. There was no appreciable difference in rate of gain and economy of gain between litters sired by different males. Nor have these results shown any tendency for the inbreeding to have a deleterious effect on rate of gain or efficiency of feed utilization. Further data are being obtained to determine the effect of inbreeding on fertility.

In the last of a series of tests involving the small, intermediate, and large types of Poland China hogs, representatives of the three types were again fed to the same degree of finish. The small type averaged 155 pounds, the intermediate 219, and the large type 260 pounds when taken off test. The average daily gains from 70 days of age to time of slaughter were 0.85, 1.33, and 1.26 pounds, respectively, for the three types. Feed requirements per 100 pounds of gain were 377, 382, and 407 pounds.

A summary of results obtained at Miles City in cooperation with the Montana station over a period of 6 years showed that hogs suitable for conversion into Wiltshire sides can be found in practically all the

American breeds of swine. In experiments involving mainly purebred Yorkshires and Chester Whites as well as pigs produced by reciprocal crosses between the two breeds, the largest percentage of carcasses suitable for conversion into Wiltshire sides was from pigs produced by Chester White dams mated to Yorkshire boars, but a considerable proportion of satisfactory carcasses also was found among the purebred Yorkshires and Chester Whites. It was also found that ordinary systems of swine production as practiced in the United States are satisfactory for the production of hogs suitable for the Wiltshire trade. The type of hog which yields a high percentage of carcasses suitable for conversion into Wiltshire sides was found to be highly desirable from the domestic standpoint.

Experiments to develop a strain of Duroc-Jersey hogs superior in pork-producing efficiency were continued in cooperation with the Georgia Coastal Plain Experiment Station at Tifton. As in the previous year both spring and fall litters were farrowed. The fall litters were sired by four males, and pigs of each litter were fed shelled corn and protein supplement on green oats pasture from weaning to a final weight of approximately 225 pounds. When the pigs were grouped according to sire, the average daily gain ranged from 1.35 to 1.42 pounds. Feed requirements per 100 pounds of gain, ranging from 397 to 446 pounds, were somewhat higher than in the preceding year.

In experiments on the physiology of reproduction, conducted cooperatively with the Missouri station, progress was confined mainly to the construction of a new device for semen collection and the development of a technique for storing semen for artificial insemination. Preliminary tests showed that sows can be successfully impregnated with a high sperm-containing fraction of semen that has been cooled gradually and stored at 10° to 12° C. for as long as 24 hours after collection. It was found that 20 to 30 cubic centimeters of the concentrated fraction of semen diluted to 50 cubic centimeters was satisfactory for impregnating sows.

In cooperation with the medical school of Johns Hopkins University, studies on the physiology of blood formation in swine were continued to determine the effect of nicotinic acid when given to pigs kept on a synthetic diet. Pigs thus handled showed a much improved growth rate, but nerve degeneration of the type mentioned in last year's report was not prevented. Neither was the administration of large quantities of yeast found to prevent degenerative changes in the spinal cord. The incidence of ataxia, however, was much lower in such animals than in those deprived of yeast. The findings of another phase of the experiment indicate that, in animals given inadequate quantities of yeast but supplied with vitamin B_1, riboflavin, and nicotinic acid, not only ataxia but also macrocytic anemia developed together with marked hyperplasia of the bone marrow. This anemia was relieved by the administration of large quantities of yeast, and the severity of the nervous symptoms decreased somewhat.

FEEDING INVESTIGATIONS

A 2-year study, including both spring- and fall-farrowed pigs, to determine the effect of supplementary feeding of protein-rich feeds on subsequent gains was completed. Thirteen sows and litters were

used in each of three groups. They had free access to a standard ration of corn, a protein supplement (composed of 50 parts of tankage, 25 parts of linseed meal, and 25 parts of alfalfa leaf meal), and mineral mixture. In addition to this diet, pigs in one group had free access to skim milk in a creep and another group had tankage in a creep. The third group was used as controls. Feeding of the added protein supplement was begun when the pigs were 3 weeks of age and continued for 11 weeks, after which they received the standard ration to a final feed-lot weight of approximately 225 pounds. During suckling, the average daily gains per pig were 0.66, 0.60, and 0.56 pound, respectively, for the groups receiving the skim milk, tankage, and no additional supplement, and the corresponding quantities of average feed consumed per 100 pounds of gain were 298, 337, and 345 pounds. From weaning to final feed-lot weight, the average daily gains per pig were 1.42, 1.38, and 1.32 pounds, respectively, for the three groups, and the quantities of feed consumed per pound of gain were 357, 367, and 363 pounds, respectively. The protein supplements in the early life of the pigs enabled them to attain market weight approximately 2 weeks earlier than pigs not receiving such supplements.

An experiment was begun to compare the relative feeding value of ground lespedeza hay at levels of 0, 5, 10, 15, and 20 percent of the winter ration for pigs fed from weights of approximately 65 to 225 pounds. The average daily gains of the different lots of pigs ranged from 1.63 to 1.75 pounds. The total quantities of feed consumed per 100 pounds of gain were 358, 388, 398, 410, and 454 pounds, respectively, for the lots receiving 0, 5, 10, 15, and 20 percent of ground lespedeza. The results indicate that more total feed per unit of gain was required as the percentages of lespedeza were increased.

In the study of the vitamin B_1 requirements of young pigs of suckling age, it was found that excellent growth can be obtained on a diet consisting of casein, sugar, minerals, cod-liver oil, and lard provided dried whey and dried pork liver are also included. The need of pigs for vitamin B_1 was shown when the whey and liver were autoclaved or treated with sulfur dioxide. Autoclaving these feeds led to a variety of effects, including convulsions, paralysis and lameness, scours, and loss of appetite. Additions of different levels of thiamin (synthetic vitamin B_1) to deficient diets promoted better appetites and growth in most cases but did not make possible the same growth and well-being as did the diet previously mentioned.

No clear-cut pathological picture was obtained from the autopsy and histological findings. It is evident that the treatment of the whey and liver caused destruction of one or more essential factors. The vitamin B_1 content of the meat appeared to reflect the vitamin B_1 content of the diet.

A troublesome disorder among pigs manifested by incoordination in use of the legs, abnormal posture, and lameness, with resulting inability to use the animals in the breeding herd or to dispose of them profitably after fattening, was described in the report for 1937. At that time, there appeared the likelihood that the condition was in part hereditary and in part nutritional. Studies were undertaken to determine the role of diet in the prevention as well as in the production of the disorder. Pigs fed in confinement on a typical growing and fattening ration of yellow corn, a protein mixture (composed of

50 parts of tankage, 25 parts of linseed meal, and 25 parts of alfalfa leaf meal), and mineral mixture have shown a small but serious incidence of the disorder. Additions of various supplements, including oats, skim milk, green forage, liver, molasses, and corn gluten meal, have failed to give complete protection in all cases at the levels fed. Omission of linseed meal and alfalfa leaf meal from the ration appeared to increase the incidence of the disorder, and heating of the simplified diet for 30 to 40 hours at a temperature of 115° to 120° C. resulted in the development of lameness and degenerative changes in more than 90 percent of the pigs fed. Histological examination of the sciatic nerve and the spinal cord showed myelin degeneration to a degree in general agreement with the severity of lameness and other outward symptoms. These results are interpreted as evidence of the dietary origin of the disorder, which appears to be similar to, if not identical with, findings reported in other investigations in which the Bureau is cooperating.

MANAGEMENT INVESTIGATIONS

In cooperation with the Zoological Division, studies are being made on swine-parasite infestation and control measures. Pigs from two litters raised on clean temporary pastures were, on the average, 5.6 pounds heavier at weaning than pigs from two litters raised in unsanitary old hog lots that had not been plowed for several years. From weaning to a final feed-lot weight of approximately 225 pounds, the pigs raised on clean ground averaged 1.62 pounds of daily gain and required 328 pounds of feed per 100 pounds of gain, whereas the pigs raised in the unsanitary hog lots averaged only 1.20 pounds of daily gain and required 369 pounds of feed per 100 pounds of gain. Infestations with protozoa and worm parasites, as indicated by the appearance of eggs and cysts in the feces, occurred in from 1 to 2 months after farrowing. In general, the worm infestations of pigs on clean lots were of shorter duration and were less severe than of pigs on the contaminated lots.

A summary of a 10-year study (1921–30) on the immunization of suckling pigs against hog cholera confirms results published by M. Dorset and S. S. Buckley, formerly of the Bureau, reporting the first 5 years' work of the project. More than 10,000 suckling pigs were treated against hog cholera by the serum-virus inoculation, in varying dosages, on 6 different farms in widely scattered areas of the country and under different climatic conditions. Pigs from practically all breeds of swine were used in the tests. The results show that pigs inoculated while nursing immune sows can be given a lasting immunity. Immunization of suckling pigs can be done at a decreased cost because of the use of less serum. The pigs are protected at an early age against the disease, and the treatment does not interfere with normal growth. Care should be taken to have the pigs in good health when the simultaneous inoculation is administered to avoid any complications that might arise owing to mixed infection.

HORSE AND MULE INVESTIGATIONS

Investigations in the breeding, feeding, care, and management of horses were conducted at three Federal stations located at Miles City, Mont., Beltsville, Md., and Middlebury, Vt. In addition, cooperative studies with horses and mules were continued with the Montana, Mis-

souri, Georgia, Mississippi, and Tennessee Agricultural Experiment Stations.

The studies on physiology of reproduction with mares and stallions, which were begun in 1937 and have been conducted jointly with the Montana and Missouri stations, were carried on principally at the station at Miles City, and at the Missouri station at Columbia. At Miles City, observations during 1937–39 of 196 oestrual periods for 80 mares of the light and draft types showed that duration of heat extends from 1 to 37 days, the average being 5.3 days. Maximum sex desire occurred 1 to 2 days before, and at the time of ovulation, with oestrus terminating 24 to 48 hours after ovulation. "Split" oestrus (discontinuous or intermittent heat) was observed, during 28 of the oestrual periods, in 31.3 percent of the mares. "Physiological" oestrus (heat in which ovulation and physiological changes of the vagina and other reproductive organs occurred but no sex desire was exhibited) was detected in 13.8 percent of the mares. The studies also showed that the average time interval between foaling and the first, or foal, heat was 11.4 days, with a range of 2 to 30 days, and that the foal and regular heat periods were of the same average length. In 60 percent of the cases under observation, ovulation was found to occur in the left ovary.

In histological studies of vaginal and uterine mucosae, it was determined that involution of the uterine mucosa was seldom complete at the onset of the foal heat period but that by the end of such oestrus it was usually similar to that of the nonpregnant mare.

During the various physiology-of-reproduction studies, 110 mares were bred, 71.8 percent of which conceived. The percentage of conceptions of lactating mares was slightly higher than that of dry mares, being 73.1 percent for the former and 70.7 for the latter. Of 26 mares bred during the foal heat period, 50 percent conceived, and in the mating of 19 maiden mares 47.4 percent of conceptions were obtained. Moreover, split and physiological oestrus and post-oestrual ovulation in themselves had no deleterious effects on the general level of fertility, as shown by the fact that 77.8, 62.5, and 75.0 percent, respectively, of the mares showing these phenomena became pregnant when artificially inseminated. Twin ovulations were observed in 3.8 percent of the cases, but no twin foalings occurred.

A new type of artificial vagina—a lightweight instrument made principally of rubber—was developed for the collection of equine semen. It has been used successfully at both Miles City and Beltsville. By the use of this vagina and its equipment, it is possible to separate the semen into fractions at the time of ejaculation and to collect as much as 317 cubic centimeters of semen at one ejaculation.

In a rather severe epizootic of equine encephalomyelitis of the western type at Miles City during the summer of 1938, 30 animals were affected. Horses of Nonius breeding were much more susceptible to attack than those of other breeding. Among all yearlings, 50 percent with Nonius breeding were affected, whereas only 11 percent of the other yearlings contracted the disease. In the foals, the corresponding percentages of disease incidence were 73.7 and 10.5. The observed differences apparently were not attributable to the distribution of the horse stock at the station, as the disease occurred with about equal frequency in all pastures.

Research with light horses was continued with the Morgan breed at Middlebury. At this station the sire-line-breeding program is now in progress, and 2 young stallions produced from selective matings are in service. The principal long-time objectives of the breeding plan are to perpetuate desirable Morgan blood lines and to improve these animals for performance under the saddle. Breeding work has been conducted at the station since 1907, and analysis of the 200 matings made during 1929–38 shows the following: The number of conceptions was 134, or 67 percent; the number of live foals dropped was 128, or 64 percent; the yearly rate of production varied from 50 to 76 percent; of the foals dropped, 54 percent were males and 46 percent were females; and 96 percent of the offspring were chestnut and bay in color.

In studies designed to develop superior techniques for measuring the capabilities of horses and mules by physical methods, data have been obtained and analyzed for some representative draft stock at Beltsville, Md., which show the degree of accuracy with which body measures and scores can be taken by competent individuals. These studies indicate that both the scores and measurements taken by any one individual at different times are more accurate than those in which different persons have made portions of the observations and that measurements are in general considerably more accurate than scores.

In the continuation of the study of substitutes for mare's milk in the nutrition of young foals, results obtained thus far with spring foals indicate that a dried-milk mixture is more satisfactory as a substitute for mare's milk than fresh cow's milk modified by the addition of sugar and water to approximate the composition of mare's milk. However, recent results substantiate previous observations that foals fed on the dried-milk mixture, while they appear thrifty and make satisfactory gains in weight, apparently do not develop bone at the same rate as similar colts suckled by their dams. Furthermore, the recent observations on the artificially fed foals indicate that the level of blood calcium is approximately 3 milligrams lower than in naturally suckled animals, in spite of the fact that cod-liver oil has been supplied to them.

At Beltsville, Miles City, and Middlebury a study is being made of the effect of age of animal, season, and nutrition on the levels of calcium, magnesium, phosphatase, and inorganic phosphorus in the serum of horses from birth to 27 years. It was found that the concentration of calcium did not vary significantly with age between 6 months and 27 years. However, in those animals on which observations were made several times during the year, a slight though definite depression of calcium level was observed in the spring. Data obtained in the spring on the level of magnesium in the serum showed an average 1.5 milligrams per 100 cubic centimeters in serum of 1-year-old animals and 2 milligrams per 100 cubic centimeters in all animals more than 2 years of age, at both Middlebury and Miles City. Data from a smaller number of animals at Beltsville showed a higher level of magnesium, particularly in the foals less than 1 year old. It was found that the phosphatase activity of serum declines rapidly during the first week and much more slowly during the rest of the growing period. In addition to the variations due to age,

there appeared to be a definite, although small, change in phosphatase activity with the season.

Results obtained on the level of inorganic phosphorus in the serum show that it changes with age and is readily influenced by nutrition, especially in the young growing animal. Changes due to age were most marked during the first 2 years. Marked variations in phosphorus levels among groups of animals of the same age may be correlated with differences in nutrition. At Middlebury low phosphorus values were obtained in foals approximately 6 months old that had been on pasture with their dams all summer without supplementary grain. Values obtained on a part of the same group after 3 months' feeding of grain and hay were somewhat higher, and those of six foals which received cow's milk in addition to the hay and grain were still higher. Moreover, the inclusion of cod-liver oil in the winter ration of foals 8 to 12 months' old appeared to effect a markedly higher level of phosphorus. Levels in the Morgan horses at Middlebury were definitely lower than those in horses of the same age and condition at Miles City and at Beltsville. The differences observed suggest a possible phosphorus deficiency in the herbage produced at Middlebury. Further significant findings show the importance of giving consideration to the effects of digestion, exercise, and advanced gestation on the level of inorganic phosphorus in the serum.

CERTIFICATION OF ANIMALS IMPORTED FOR BREEDING

Under the provisions of paragraph 1606 of the Tariff Act of 1930, certificates of pure breeding were issued for 13,811 breeding animals imported during the fiscal year. Following are the total importations by classes and breeds during this year:

Cattle:	*Number*
Aberdeen Angus	188
Ayrshire	1,320
Brown Swiss	9
Canadian	18
Dutch Belted	3
Galloway	2
Guernsey	101
Hereford	1,390
Highland	1
Holstein-Friesian	5,751
Jersey	736
Red Polled	6
Shorthorn	526
Total	10,051
Horses:	
American Saddle	8
Arabian	14
Belgian	146
Cleveland Bay	1
Clydesdale	40
Hackney	11
Percheron	84
Shetland Pony	18
Shire	3
Standardbred	8
Suffolk	56
Thoroughbred	92
Welsh Pony	2
Total	483

Sheep:	*Number*
Cheviot	1
Corriedale	3
Cotswold	81
Dorset Horn	9
Hampshire	143
Leicester	23
Lincoln	85
Oxford Down	62
Shropshire	108
Southdown	815
Suffolk	1,076
Total	2,406
Goat:	
Toggenburg	1
Total	1
Swine:	
Berkshire	3
Tamworth	6
Yorkshire	50
Total	59
Ass:	
Poitou	1
Total	1
Cats: All breeds	13
Dogs: All breeds	797

There was a decrease of approximately 10 percent in the total importations of livestock during this period as compared with the importations for the previous fiscal year.

POULTRY INVESTIGATIONS

POULTRY BREEDING

Two fairly definite lines of White Leghorns have been established on the basis of eggshell quality, measured by the percentage of moisture lost by incubated eggs. Eggs produced by each of the two lines had an average moisture loss of 9.2 and 6.6 percent, respectively, for the first 14 days of the incubation period. This work is being continued in an effort to determine the inheritance of the factors involved in eggshell quality.

A study was made of the rate of deterioration of eggs of 5 lines of White Leghorn pullets, totaling 132 birds. Although there were no significant differences in the fresh eggs laid by the 5 lines, these eggs differed materially after they were held several weeks. Fresh eggs from 2 of the lines had the same mean percentage of thick white, but after they had been held at approximately 78° F. for 21 days, the mean percentage of thick white in those of 1 line was 32 and in the other 13. The results from the 5 lines showed no correlation between percentage of thick white in fresh and held eggs. This work also shows that rate of deterioration of thick white depends on hereditary factors as well as on conditions under which they are held.

In further investigations to identify the sex of day-old chicks by external characteristics, 1,105 crossbred chicks from a mating of a Barred Plymouth Rock male to Rhode Island Red females were observed and dissected. An accuracy of 64.9 percent was attained in sexing these crossbred chicks by their down color. The female chicks had the greater amount of white in down color. Among the crossbred chicks that showed silver striping in down color, 80 percent were females. Among those with brownish colored heads, 90 percent were males. These 2 groups, however, comprised only 27 percent of the 1,105 chicks.

Observations on the down, shank, and beak color in Jersey Black Giant, Jersey White Giant, and White Plymouth Rock chicks indicated that the intensity of melanic pigment in the down, shank, and beak was not a reliable indication of sex.

In connection with the correlation of external characteristics and sex in baby chicks, an investigation was made of the history of the sexual dimorphism of the down color and adult plumage of the Pilgrim goose. This goose was found to be sexually dimorphic both in down and adult plumage. The male goslings are white and sometimes carry a grayish tint in the juvenile plumage but are pure white as adults. The male goslings also have light-colored bills. The female goslings, on the other hand, are grayish in down color and have dark bills. As adult geese they continue to retain the dark gray plumage, resembling the Toulouse goose in color, although age appears to increase the amount of white color in the head and neck. Although both ganders and geese have dark eyes at hatching, the eyes of the ganders are blue at maturity. This sexual dimorphism in down or plumage and bill color enables one to distinguish the sex at any age.

At Beltsville the average egg weight of Single-Comb White Leghorns was increased by selective breeding from 54.7 grams, or about 23.2 ounces per dozen, in 1934–35, to 58.5 grams, or 24.8 ounces per dozen, in 1937–38. Since eggs from this breed are now above the standard egg weight of 56.7 grams, egg weight is now a minor problem in this breed at Beltsville and no longer hinders progeny selection and breeding for other factors, especially egg production and viability. The average egg weight of Rhode Island Reds was increased from 53.4 grams in 1936 to 56.6 grams in 1937–38. It appears that improvement in egg weight can be brought about relatively rapidly by breeding.

During the period that egg weight was being increased in the White Leghorn flock, it was observed that the eggs, during first-year production, reached standard weight (24 ounces per dozen) earlier each succeeding year. In 1934–35, when the average annual egg weight was only 23.2 ounces, the pullets did not produce eggs that weighed an average of 24 ounces per dozen in any month. In 1935–36, when the flock's average annual egg weight was 23.6 ounces per dozen, the eggs attained an average weight of 24 ounces per dozen in March. In 1936–37 the average annual egg weight was 24 ounces, and the standard weight of 24 ounces was reached in February. In 1937–38 the average annual egg weight was 24.8 ounces per dozen, and the eggs attained a weight of 24.3 ounces per dozen in January. In 1938–39 a weight of 24.6 ounces was reached in December, or 4 months earlier than in 1935–36. Reducing the time required for pullets to lay eggs of standard weight is equally as important from a commercial standpoint as improving the average annual weight of eggs.

Considerable improvement in egg production in Light Sussex chickens was made through selection and progeny-test methods. In 1933 the average annual egg production of the progeny of imported Light Sussex was 129.2 eggs. In 1938 production had been increased to 177.5 eggs.

Further progress has been made in breeding turkeys for small size, early maturity, good market quality, and good reproduction. A fair degree of uniformity of type has been obtained.

A genetic factor or factors preventing the development of the breast muscles in turkeys has been observed. This condition appears to be a dominant one. Its relationship to normal breast development is of special interest since the percentage of breast meat affects the market value of turkeys to a great extent.

A study has been completed on the manure production of 22 adult, standard-size White Holland turkeys, of which 20 were hens and 2 were toms. Manure production averaged 2.24 pounds per bird per week, or 1.07 pounds per pound of grain and mash consumed. The fresh manure contained approximately 75 percent of water. During the test period in October 1938, 72.7 percent of the manure was deposited during the daytime, 27.3 percent at night.

POULTRY INCUBATION AND PHYSIOLOGY

An investigation involving several years of work has been made on the inheritable causes of early embryonic mortality. The mortality

of embryos from certain matings was approximately 34 percent during the first 4 days of incubation, whereas that in normal matings averaged only about 4 percent. The probable cause of the increased mortality is a lethal factor, with one or more recessive autosomal genes involved.

The technique previously employed in artificial insemination of chickens was successfully applied to turkeys. Thirty-one turkey hens, artificially inseminated with 0.05 cubic centimeter of turkey semen at intervals of 1, 2, 3, and 4 weeks, laid 948 eggs with an average fertility of 80 percent. A valuable old tom which, in a pen of 10 hens, fertilized only 7.5 percent of the eggs gave 88.4 percent fertility when artificial insemination was used.

From a study of the semen production of crossbred male chickens, the following data were obtained: Semen production of the cockerels began at about 222 days of age and increased gradually until 275 days of age, when it averaged approximately 1 cubic centimeter per bird per daily collection. Cocks from the same flock, at 1½ years of age, produced 1 cubic centimeter of semen per bird per daily collection. Size of testes was found to be rather highly correlated with semen production. Size of comb and wattles, general outward appearance of the bird, evident sexual activity, and lack of such activity are not reliable indexes of semen production.

POULTRY FEEDING

A study was made of the effect of different levels of protein intake on the rate of growth of chickens and turkeys and on the efficiency of feed utilization. In chickens, during the first 14 weeks, the average live weights of the various groups were in the order of the quantities of protein consumed. After the age of 14 weeks, the advantage in growth previously made on the diets of higher protein content was maintained to maturity, but no further advantage was gained. On the basis of the quantity of feed required per pound of gain in live weight, the best level of protein intake at all ages was about 21 percent. As the level of protein intake was increased or decreased from this value, smaller gains in live weight were made per pound of feed consumed. The efficiency of feed utilization for growth on any diet of fixed protein content decreased with age, and it was demonstrated that the efficiency was a linear function of live weight. It was found that after the maximum live weight has been reached, 13 percent of protein in the diet is adequate for the maintenance of male chickens.

The ability of growing turkeys to adjust their protein intake was studied by permitting them to have access at will to grain mixtures and mashes of different protein content. Under these conditions it was found that turkeys can make satisfactory growth when the protein content of the mashes ranges from 18 to 30 percent, if at least 7.5 percent of the mash is protein from animal sources. In general, the turkeys tended to eat more grain and less mash as the protein content of the mash was increased but the tendency was not strong enough to stabilize the protein intake until the protein content of the mash was increased to about 26 percent. However, between the ages of 21 and 28 weeks the turkeys consumed about the same percentage of protein regardless of whether the mash contained 18 or 30

percent of it and the average total protein intake was about 16 percent.

In continued study of alfalfa leaf meal as a source of vitamin A for poultry, a dehydrated and a specially sun-cured alfalfa leaf meal were stored in paper-lined burlap bags and used in five chick-feeding tests, after the meals had been in storage for periods ranging from 1 month to more than 2 years. Both meals showed a slight decrease in vitamin A activity after 7 to 9⅓ months of storage, a somewhat more marked decrease after 16⅓ months, and a very pronounced decrease after 24 to 26⅓ months. The vitamin A activity of the dehydrated meal decreased at such a rate that, when it had been stored for 14 months, it contained no more vitamin A than did the specially sun-cured meal after it had been stored for 24 months.

Since the interior quality of eggs is adversely affected if they are retained for a long time in the oviduct, a study of the time factor in egg production was undertaken. This study showed that the method of feeding—even the limiting of the feed consumption to 75 percent of the ad libitum intake—had no effect on the time interval between the laying of successive eggs. Also, the age of the chickens and the degree of confinement had no effect on the interval. However, in Rhode Island Reds there was a shorter interval between successive eggs in 2-, 3-, and 4-egg cycles than in White Leghorns.

NATIONAL POULTRY IMPROVEMENT PLAN

The National Poultry Improvement Plan was adopted in 2 additional States, Maine and Tennessee, making a total of 44 States that cooperated with the Bureau during the year. Table 2 shows that the numbers of poultry breeders, hatcherymen, and flock owners cooperating in the plan have increased rather consistently, and that the increase was especially marked during the 1939 fiscal year.

TABLE 2.—*Extent and nature of participation in the National Poultry Improvement Plan during the first 4 years*

Item	Extent of participation during year ended June 30—			
	1936	1937	1938	1939
	Number	*Number*	*Number*	*Number*
States	34	41	42	44
Hatcheries	1,017	1,239	1,478	2,033
Egg capacity of hatcheries	38,066,000	52,591,786	60,523,222	75,782,922
Breeding flocks	23,813	30,558	28,820	42,591
Breeding birds	3,522,409	6,535,907	5,948,498	8,653,568
U. S. R. O. P.[1] flock owners	[2]	301	298	317
U. S. R. O. P. flocks	190	352	353	396
Birds entered in trap-nest flocks	66,547	112,202	108,183	124,937
U. S. R. O. P. breeding pens	[2]	1,675	1,966	2,206
Females in U. S. R. O. P. pens	8,207	22,322	26,135	30,081

[1] United States record of performance.
[2] Complete information not available.

At the conservative estimate of 2 chicks produced per hatching-egg capacity, approximately 152 million chicks were hatched under the provisions of the plan during the year. This amounts to about 23.5 percent of the total number of chicks raised on farms in the United

States. The value of having all breeding birds officially tested for pullorum disease is being recognized by more poultrymen each year. For the year ended June 30, 1936, only 58 percent of the birds under the plan were officially tested for pullorum disease as compared with 78 percent in 1939.

Improvement was noted in the compliance with the provisions of the plan and the general quality of the flock-selecting and pullorum-testing work. One of the most encouraging features was the increased number of United States record of performance breeders who are selecting their breeding birds on the basis of production and viability records of the daughters and sisters.

BIOCHEMIC DIVISION

Much of the work of the Biochemic Division, under the direction of Robert M. Chapin, Chief, consisted, as in the past, of services to other divisions of the Bureau. These services included analytical control of commercial disinfectants and dips offered for official use, and of preservatives in commercial biological products for the prevention of animal disease. Other services were testing the composition and sensitivity of commercial stained antigen for the detection of pullorum disease in chickens, and producing tuberculin and anti-hog-cholera serum and hog-cholera virus for official use. The Division also conducted research activities of which the following merit special mention.

HOG CHOLERA

Farm experiments were continued to demonstrate the efficacy, under practical conditions, of phosphated crystal-violet vaccine against hog cholera. The formula for this vaccine was given in the 1937 report. The procedure used in these farm experiments is as follows:

Herds of pigs in the vicinity of the Division's experiment station at Ames, Iowa, are vaccinated on the owners' premises and are left entirely under the owners' management, which represents average good practice. When the owner of a herd desires to send his hogs to market, a representative group, usually four animals, is purchased and brought to the station for immunity tests, which are performed by injection of 2 centimeters of defibrinated-blood virus.

The phosphated crystal-violet vaccine now has been used on a total of 69 farm herds in which the pigs were at least 8 weeks of age at the time of vaccination. The efficacy of the vaccination appeared excellent in 45 of these herds because no hog in the groups obtained from them for immunity tests displayed more than a short indisposition following the injection of virus. Certain hogs from each of the remaining 24 herds suffered more conspicuous reactions, of various degrees of severity, but most ultimately recovered in good condition. From the 69 herds, a total of 263 hogs were obtained for test. Of these, 211 (80 percent) evinced a highly satisfactory degree of resistance to the injection of virus. Only 10 of the remaining hogs died, so that 96 percent of those tested were at least protected against the ordinarily fatal outcome of the disease.

The results in herds in which the pigs were less than 2 months old at the time of vaccination were less favorable. It appears that 2 months is the minimum age at which pigs can be vaccinated with

crystal-violet vaccine with reasonable assurance that the single dose will give them fairly good protection against hog cholera until they reach marketable age.

The accumulated data demonstrate that under favorable conditions the vaccine in a single subcutaneous dose of 5 cubic centimeters is capable of stimulating a highly satisfactory degree of immunity. For various reasons, however, certain pigs fail to acquire or retain strong immunity and such pigs may constitute a considerable proportion of a herd. Against the probability that crystal-violet vaccine may establish a less complete and lasting immunity in many herds than could be attained by serum-virus inoculation should be weighed the advantage that the vaccine neither conveys the infection of hog cholera nor incites any sort of postvaccination disturbance.

DISINFECTANTS

The time required by a given disinfectant at a given temperature to kill a given micro-organism is inversely proportional to the concentration of the disinfectant. The mathematical relation between concentration and time, variously referred to as concentration exponent or dilution coefficient, is a matter of practical importance in the use of disinfectants and may yield a clue to the mechanism of disinfectant action. Studies extending over several years have given noteworthy results, as follows: The germicidal activities of the alcohols fall off rapidly with increasing dilution; the activities of various phenols, including the much-used cresols, are much better retained, phenol itself being particularly good in this respect; the addition of soap to a phenolic disinfectant is of notable benefit in retarding the rate at which activity decreases with dilution. The magnitude of the exponent, or coefficient, for a given disinfectant depends to a considerable extent on the species of test organism employed. With some disinfectants and some organisms, the exponent, or coefficient, remains constant over the temperature range of 10° to 30° C.; in other cases, changes of magnitude in both directions have been observed. The temperature of 40°, however, has appeared to be invariably beneficial in retarding the rate at which activity decreases with dilution.

MEAT FOOD PRODUCTS

A comprehensive investigation of the nutritive value of various typical commercial fats and oils used in cooking has been in progress for several years. The two coefficients, growth-promoting efficiency and digestibility, are determined through feeding experiments with albino rats, and efforts have been made to correlate the relative magnitudes of these coefficients with the chemical composition or the physical constants of the various fats. Preliminary data were given in last year's report. Puzzling variations continue to appear, even among different specimens of one class of fat. For instance, according to results thus far, kettle-rendered leaf lard consistently appears to be of somewhat lower nutritive value than refined steam lard. On the whole, lard ranks near the top of the list in both digestibility and growth-promoting efficiency; oleo oil ranks near the bottom. Hydrogenation of either lard or vegetable oil sometimes reduces the nutritive value to a considerable extent. However, the data obtained indi-

cate that when the diet is otherwise adequate any of the common cooking fats on the market, whether of animal or vegetable origin or a mixture, may be used without fear of a possible nutritive deficiency.

It has long been presumed, without support of direct evidence, that protein can be converted into fat in the animal body. Such evidence has been obtained in an experiment in which albino rats were fed a diet containing only purified casein, vitamins, and mineral salts, with no fat or carbohydrate. After 60 days the carcasses of these rats were found to contain two and one-half times the quantity of fat acid which an equal number of their litter mates had at the beginning of the feeding period, the average synthesis being nearly 7 grams of fat acid per rat. Other investigators recently have published similar evidence. But the albino rat appears unable to synthesize the unsaturated acids, linoleic or others, which are essential for normal growth and health, either from protein or from carbohydrate. In rats on a fat-free diet the original store of these important unsaturated acids becomes progressively depleted.

TUBERCULIN

In studies on the availability of nitrogen in various compounds for growth of the human type of the tubercle bacillus, no significant growth was obtained from malonamide or from the ammonium salts of formic, levulinic, or mesoxalic acids. It was confirmed, contrary to a recent report from the Soviet Union, that little growth is obtainable from ammonium oxalate.

The nitrogen metabolism of the organism was studied in cultures on asparagin medium. The constituent nitrogen was found to be rapidly reduced to ammonia, the amide grouping being first affected. When such cultures became acid, the decrease in hydrogen-ion concentration occurred about the time that the nutrient nitrogen was reduced to a minimum; however, no consistent relation was detected between the final hydrogen-ion concentration and residual ammonia in the filtrate. The work led to the conclusion that the nitrogenous constituents of the medium are the chief source of alkali and that glycerol is the chief source of acid, which is probably produced as an intermediate oxidation product and is in turn further oxidized.

The percentage of nitrogen in tubercle bacilli was found to vary with both the age of the culture and the composition of the medium.

FIELD INSPECTION DIVISION

Under the direction of S. O. Fladness, Chief, the Field Inspection Division continued activities with respect to the control and eradication of sheep and cattle scabies and certain other animal diseases. Regulations designed to prevent the introduction of communicable diseases of foreign origin, as well as regulations governing the inspection, humane handling, and safe transport of export animals, were also administered by this Division.

ERADICATION OF SCABIES

In cooperation with authorities of the various States, sheep-scabies eradication continued to progress as in previous years. Total inspections in the field and supervised dippings numbered 14,963,409 and

1,013,389, respectively. Flocks in which infection was found included 294,518 sheep. Approximately 90 percent of these infected sheep were reported from Louisiana, where a systematic eradication campaign was conducted with excellent results in the 4 parishes under quarantine. In addition to the quarantined areas, a considerable amount of scattered infection still existed in the midwestern farming region. Substantial progress in the control and eradication of the disease was made in several States in that region, notably in South Dakota.

Cooperative cattle-scabies eradication also was continued. The number of herds found to be infected was greatly reduced, especially noteworthy progress being made in Nebraska, where the greater part of the remaining infection existed. In New Mexico it is believed that the last center of infection was eliminated, but watchfulness will be necessary for some time. During the year, 2,459,288 inspections were made in the field and 156,885 dippings were supervised. The number of cattle in infected herds was 32,395, a marked decrease below that of the previous year. A few cases of sarcoptic scabies of cattle in Texas were promptly eradicated.

OTHER DISEASE-CONTROL WORK IN THE FIELD

There was no material change during the year with respect to the incidence of dourine, which is believed to be practically eradicated from the United States. The area comprising parts of Idaho, Nevada, and Oregon, where a slight infection remains, continued under State quarantine. A number of horses moving out of the area were tested and only two gave a positive reaction, indicating that the infection remaining is very slight.

No serious outbreaks of anthrax occurred during the year. Bureau employees continued to furnish assistance in administering preventive treatment to Indian-owned cattle on reservations in South Dakota, where infection is known to exist.

In connection with their regular duties in the field, Bureau veterinarians inspected 1,078 horses and mules for interstate shipment. Of these, 159 were mallein-tested for glanders without any positive reactions.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS

Careful inspection was made of all horses, ruminants, and swine offered for importation. The importation of domestic ruminants and swine from countries in which foot-and-mouth disease is known to exist is prohibited by law. Because of the prevalence of this infection in many parts of the world, there were only a few countries from which animals of these kinds could be imported. Canada and Mexico were the chief sources of supply, and there was a marked increase in importations from those countries, particularly Mexico, over those of any recent year. The number and kind of animals imported during the year are shown in table 3. A small number of domestic fowls and pigeons also were inspected at ports of entry.

TABLE 3.—*Animals inspected for importation, fiscal year 1939*

Port of entry	Cattle	Swine	Sheep	Goats	Horses and mules	Asses	Other animals
Baltimore					8		4
Boston	166	1			54		1
Honolulu, Hawaii							
Los Angeles					16		
Miami					206		
New Orleans					32		1
New York	260		1		741	10	66
San Francisco			1		3		1
San Juan, P. R	1,345	29	6		12	2	3
Tampa					7	1	
Canadian border ports	233,120	273	2,950	16	6,929	12	50
Mexican border ports	486,243	3	4,965	27	12,146	529	106
Total	721,134	306	7,923	43	[1] 20,154	554	233
Held in quarantine	324		2		30		65
Refused entry—							
From Mexico	[2] 21,899				135		
From Canada	13				1		
Under bond for reexport	8,279				424		

[1] Of this number 1,706 were mules.
[2] Rejected because of tick infestation except for 1,500 cattle, which were rejected for scabies infection.

The Bureaus of Customs and Public Health Service continued to render the Bureau of Animal Industry valuable cooperative assistance in the enforcement of import regulations. Public Health Service officials at ocean ports obtained for Bureau inspectors 13,060 declarations of shipmasters reporting the presence or absence on their vessels of prohibited meat, livestock, and garbage. Customs officers cooperated by preventing the landing of such products and animals. Prohibited meats were shown to be present on 4,279 vessels and prohibited livestock on 12. The livestock, totaling 57 animals, were slaughtered and the spaces occupied by them on the vessels disinfected.

CONTROL OF IMPORT ANIMAL BYPRODUCTS, HAY, AND STRAW

The careful administration of regulations designed to prevent the introduction of anthrax, foot-and-mouth disease, and rinderpest through the medium of import animal byproducts and feeding materials was continued. Tanneries and like establishments receiving restricted import products of this kind were required to provide separate storage and other facilities necessary in the disinfection of the products themselves or in the disinfection or control of the effluents incident to their processing. Cars to the number of 1,232, used in the transportation of restricted import products, were disinfected, as were trucks, ship compartments, and premises involved in the handling of such products.

Hay and straw packing materials proceeding from countries where foot-and-mouth disease exists were required to be destroyed unless shown by acceptable certificates to have been properly disinfected before use. Instances of this kind are now comparatively few. Supervision was maintained over calf stomachs imported for the manufacture of rennet extracts and over animal glands for the manufacture of biological products when originating in countries infected

with foot-and-mouth disease. The importation of animal manure from various countries was controlled through the requirement that prior permits be obtained.

INSPECTION AND SAFE TRANSPORT OF EXPORT ANIMALS

In compliance with Department regulations and in order to meet requirements of receiving countries, 6,746 animals of various kinds were inspected for exportation. Supervision was also maintained over the equipment of vessels carrying export animals to assure proper space and fittings for their humane treatment and safe transport. In table 4 are shown the number and kind of animals inspected for export.

TABLE 4.—*Inspection and testing of animals for export, fiscal year 1939*

Kind of animal	To Canada	To Mexico	To other countries	Total	Kind of animal	To Canada	To Mexico	To other countries	Total
Cattle	103	962	1,437	2,502	Mules	136	36	1,027	1,199
Swine	17	14	220	251	Asses		9	10	19
Sheep	56	874	125	1,055	Other animals			2	2
Goats	6	123	119	248					
Horses	335	225	910	1,470	Total	653	2,243	3,850	6,746

INTERSTATE INSPECTION DIVISION

As a result of reorganization changes within the Department, effective October 16, 1938, there was established in the Bureau of Animal Industry the Interstate Inspection Division, with A. W. Miller, Chief. The function of this new unit is to continue the activities of the former Packers and Stockyards Division relating to interstate transportation of livestock and the administration of livestock transportation and quarantine laws.

CONTROL OF INTERSTATE TRANSPORTATION OF LIVESTOCK

In the supervision of the interstate transportation of livestock to prevent the spread of animal diseases, Bureau inspectors at 48 stockyards in 46 cities inspected 18,542,168 cattle and 23,147,679 sheep. Of these animals, 1,347 cattle and 555,096 sheep were dipped under supervision to comply with the regulations of the Department and the various States to which they were destined. The number of swine inspected was 23,868,654, of which 218,865 were immunized and disinfected against hog cholera under Bureau supervision for distribution for feeding and breeding purposes. The transportation of livestock by motortruck, rather than by railroad, has greatly increased in recent years and made more difficult the conduct of this inspection service.

Efforts were continued to reduce to a minimum losses among stocker and feeder cattle and sheep on account of infectious disease. All pens, chutes, and alleys in which infected animals were handled, and divisions in which all sheep were handled, in public stockyards, were cleaned and disinfected under Bureau supervision.

There were received at the Bureau stations, during the year, 722 cars carrying animals affected with communicable diseases. Under Department regulations or on request of Canadian Government, State, and railroad officials, 5,198 cars were cleaned and disinfected under the supervision of Bureau employees. An effort was made to clean and disinfect under Bureau supervision all trucks which had been used in the interstate transportation of animals affected with contagious, infectious, or communicable diseases.

Experienced veterinary inspectors at public stockyards continued to give particular attention to the inspection of all ruminants and swine for foot-and-mouth disease, no case of which was found.

Bureau employees at public stockyards devoted much time to expediting the movement of cattle that had reacted to tests for Bang's disease and tuberculosis through stockyards to slaughtering establishments.

ENFORCEMENT OF TRANSPORTATION AND QUARANTINE LAWS

In the administration of the 28-hour law many improvements were made in the facilities for feeding, watering, and resting livestock while in transit; 186 alleged violations of the 28-hour law were reported to the Bureau. The Bureau transmitted 125 apparent violations to the Solicitor for presentation to the Attorney General. Penalties amounting to $14,200 were imposed in cases decided in favor of the Government. Five employees devoted most of their time to this work, but the evidence was collected and the reports prepared largely by employees stationed at public stockyards whose time was devoted chiefly to other lines of work.

There were reported to the Bureau 23 alleged violations of the quarantine laws. Ten alleged violations were transmitted by the Bureau to the Solicitor for prosecution. In cases decided in favor of the Government, fines imposed amounted to $1,400.

MEAT INSPECTION DIVISION

The activities of the Meat Inspection Division were directed by Edward C. Joss, Chief. Inspection of cattle, sheep, swine, and goats, and meat products from them and, in a limited way, of horses and horse meat products, was conducted at 684 establishments located in 249 cities and towns. Inspection was inaugurated at 21 establishments and withdrawn from 38. The withdrawal of the inspection was made necessary at 37 establishments on account of discontinuance of the preparation of meat and meat food products for interstate or foreign commerce, and at 1 establishment on account of violation of regulations. At the close of June 30, there were 646 establishments operating under inspection in 242 cities and towns.

Cooperative service was rendered to 13 Government agencies in the examination of meat and meat food products for condition and conformance to specifications.

The activities included the reinspection and certification of 30.5 percent more meat and meat food products for export shipment and

the examination at ports of entry of about 15 percent less foreign meat and meat food products than in the previous fiscal year.

ANTE-MORTEM AND POST-MORTEM INSPECTIONS

The results of the ante-mortem and post-mortem inspections are given in tables 5 to 8, inclusive.

TABLE 5.—*Ante-mortem and post-mortem inspections of animals, fiscal year 1939*

Kind of animal	Ante-mortem inspection				Post-mortem inspection		
	Passed	Suspected [1]	Condemned [2]	Total	Passed	Condemned [2]	Total
Cattle	9,449,813	91,425	3,064	9,544,302	9,486,009	55,229	9,541,238
Calves	5,368,419	7,208	2,851	5,378,478	5,366,490	17,015	5,383,505
Sheep and lambs	17,497,929	6,327	6,766	17,511,022	17,467,015	37,241	17,504,256
Goats	4,000	5	13	4,018	3,984	21	4,005
Swine	38,562,293	92,629	12,950	38,667,872	38,563,428	93,109	38,656,537
Horses [3]	28,102	56	105	28,263	27,980	178	28,158
Total	70,910,556	197,650	25,749	71,133,955	70,914,906	202,793	71,117,699

[1] "Suspected" is used to designate animals suspected of being affected with disease or condition that may cause condemnation in whole or part on special post-mortem inspection.
[2] For causes and additional condemnations see tables 6 to 8 inclusive.
[3] Horses are slaughtered and their meat handled and prepared in establishments separate and apart from those in which cattle, calves, sheep, goats, and swine are slaughtered and their meat handled and prepared.

TABLE 6.—*Number of animals condemned for various diseases and conditions on ante-mortem inspection, fiscal year 1939*

Cause of condemnation	Cattle	Calves	Sheep and lambs	Goats	Swine	Horses
Abscess					18	2
Anthrax					1	
Arthritis and other bone diseases					28	
Dermatitis						1
Dropsical diseases	1				1	
Emaciation	6				73	
Enteritis		1			4	
Equine encephalomyelitis						1
Hog cholera					1,181	
Immaturity		23				
Injuries	2				2	
Mastitis	3					
Metritis	8					
Moribund [1]	2,946	2,823	6,759	13	10,623	100
Pericarditis	9				1	
Pneumonia	31	2	7		53	
Pseudoleukemia	1					
Pyrexia	12				238	
Septicemia and pyemia	23	1			26	
Tetanus		1				
Tumors, carcinomata, sarcomata, etc	22				1	1
Total	3,064	2,851	6,766	13	12,950	105

[1] Includes animals found dead in the ante-mortem pens at time of inspection.

TABLE 7.—*Number of carcasses condemned for various diseases and conditions on post-mortem inspection, fiscal year 1939*

Cause of condemnation	Cattle	Calves	Sheep and lambs	Goats	Swine	Horses
Actinomycosis	909	85			3	
Anaplasmosis	75	7				
Anthrax					148	
Arthritis and other bone diseases	188	428	786		8,314	
Asphyxia	2	11	14		333	
Blackleg	12	3				
Caseous lymphadenitis			4,486	4		
Cellulitis	1				16	
Contamination	211	2	271		1,612	
Cysticercosis	175	17	533		53	
Dropsical diseases	71	4	18		239	
Emaciation	5,899	2,846	9,223	9	320	7
Equine encephalomyelitis						2
Hog cholera					14,641	
Hydrocephalus			3			
Hydronephrosis	6	1	1		85	
Icterus	151	525	2,342		4,731	
Immaturity		5,103				
Influenza					5	
Injuries	2,842	404	1,272		1,828	9
Johne's disease	1					
Melanosis	55	99	97		148	22
Necrobacillosis	10					
Necrosis	6				5	
Omphalophlebitis		156	1			
Parasitic diseases	136	3	30		589	
Pneumonia, pleurisy, enteritis, peritonitis, etc	25,237	5,358	13,428	1	21,716	68
Pregnancy and recent parturition	67		62		10	
Pseudoleukemia	1,399	49	15		225	4
Septicemia and pyemia	9,919	1,679	3,348		20,455	10
Sexual odor				5	3,849	
Skin diseases	7	2			1	
Splenetic fever	7					
Swine erysipelas					92	
Toxemia	9	7			3	
Tuberculosis	3,254	65	28		13,190	
Tumors, carcinomata, sarcomata, etc	4,321	117	271		379	56
Uremia	247	44	1,012	2	119	
Xanthosis	12					
Total	55,229	17,015	37,241	21	93,109	178

TABLE 8.—*Number of parts of carcasses*[1] *condemned for various diseases and conditions on post-mortem inspection, fiscal year 1939*

Cause of condemnation	Parts of carcasses of—				
	Cattle	Calves	Sheep and lambs	Swine	Horses
Actinomycosis	168,035	5,777		2	
Arthritis and other bone diseases	27	4	85	118	
Caseous lymphadenitis			9		
Cellulitis	11	1		1,274	
Contamination	161	143	52	854	
Hydrocephalus	1	4			
Injuries	1,923	198	140	47,427	6
Melanosis	36	49	1	4	24
Necrobacillosis			10	1	1
Necrosis	45	2			
Parasitic diseases	10			2	
Tuberculosis	5,071	97		193,847	
Tumors and abscesses	14,086	4,356	96	318,864	136
Xanthosis	30				
Total	189,436	10,631	393	562,393	167

[1] In addition to the above parts, 986,510 cattle livers and 41,239 calf livers were condemned on post-mortem inspection.

INSPECTION OF MEAT AND MEAT FOOD PRODUCTS

Meat and meat food products prepared and processed under supervision are shown in table 9, which is a record only of inspection performed and not a statement of the actual quantity prepared.

TABLE 9.—*Meat and meat food products perpared and processed under supervision, fiscal year 1939* [1]

Product	Quantity	Product	Quantity
Placed in cure:	*Pounds*	Canned meat and meat food products—Continued.	*Pounds*
Beef	120, 944, 267	Soup	196, 937, 933
Pork	2, 386, 143, 503	All other	70, 858, 911
Smoked and/or dried:		Bacon, sliced	253, 760, 660
Beef	53, 190, 852	Lard:	
Pork	1, 397, 034, 478	Rendered	1, 133, 167, 829
Sausage:		Refined	866, 822, 790
Fresh, finished	114, 524, 385	Oleo stock	116, 606, 064
Smoked and/or cooked	569, 054, 887	Edible tallow	81, 832, 458
To be dried or semidried	108, 504, 582	Compound containing animal fat	336, 941, 301
Loaf, headcheese, chili con carne, jellied products, etc	103, 226, 439	Oleomargarine containing animal fat	47, 846, 734
Cooked meat:		Miscellaneous	15, 853, 297
Beef	11, 135, 622	Horse meat:	
Pork	182, 937, 452	Cured	3, 306, 966
Canned meat and meat food products:		Ground	1, 711, 536
Beef	73, 999, 955	Edible oil	38, 290
Pork	172, 685, 083		
Sausage	30, 379, 887	Total	[2] 8, 440, 446, 161

[1] The following quantities of meat and meat food products were condemned on reinspection and destroyed for food purposes on account of having become sour, tainted, rancid, unclean, or otherwise unfit for human food: Beef, 1,722,727 pounds; pork, 3,498,792 pounds; mutton, 63,529 pounds; veal, 47,163 pounds; goat meat, 40 pounds; horse meat, 6,694 pounds; total, 5,338,945 pounds.

[2] This figure represents "inspection pounds" as some of the products may have been inspected and recorded more than once due to having been subjected to more than 1 processing treatment such as curing first and then canning.

MEAT AND MEAT FOOD PRODUCTS CERTIFIED FOR EXPORT

There were inspected and passed for export during the year the following products: Beef and beef products, 28,610,417 pounds; mutton and lamb and their products, 2,501,831 pounds; pork and pork products, 363,770,946 pounds; horse meat and its products, 3,002,596 pounds; total, 397,885,790 pounds. There were issued 35,848 official meat-inspection certificates in connection with the foregoing. There were also issued 3,695 certificates covering the exportation of 23,623,680 pounds of inedible animal products.

INSPECTION OF MEAT AND MEAT FOOD PRODUCTS WHEN OFFERED FOR ENTRY INTO THE UNITED STATES

Table 10 shows foreign meat and meat food products inspected and passed when offered for entry into the United States, with principal countries of origin and kind and quantity of products.

TABLE 10.—*Foreign meat and meat food products passed for entry, fiscal year 1939*

Country of origin	Fresh meats			Canned meats			Cured meats	
	Beef and veal	Pork	Mutton and lamb	Beef	Pork	Other	Beef	Pork
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Argentina				29,776,822	10	1,543	574	
Australia	40,184		57,593	67				
Brazil				31,084,826	42	72	694,093	
Canada	1,035,267	2,156,469	106	481	513	284	17,040	573,956
Czechoslovakia					115,507	96		1,577
Denmark					1,828,657	136,507		28,150
Estonia					490,182	42		699
Germany					274,680	63,278		58,838
Great Britain				233	839	3,486		185
Hungary				998	4,694,129	2,923		3,017
Italy					6,790			13,725
Latvia					561,758	88		
Lithuania		755,508			1,251,584	22,090		9,154
Netherlands					1,294,189	53,710		153,513
New Zealand	1,442,178	804	83,595			10		250
Paraguay				4,189,965				
Poland					32,417,277	238,985		1,158,327
Rumania					1,106,837	177		23,745
Switzerland					715	272	110	248
Uruguay				16,180,188		71	1,196,815	9,766
Yugoslavia					178,528			
Other countries	30,512			15,164	70,758	64,738	1,376	119,398
Total	2,548,141	2,912,781	141,294	81,248,744	44,292,995	588,372	1,910,008	2,154,548

Country of origin	Sausage (not canned)	Oleo products	Edible tallow	Miscellaneous	Total
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Argentina	7,371	326,454		203,771	30,316,545
Australia				86,721	184,565
Brazil				138,165	31,917,198
Canada	142,271	50	4,297	1,960,124	5,890,858
Czechoslovakia					117,180
Denmark	14,216			27,669	2,035,199
Estonia				3,250	494,173
Germany	96,912			1,584	495,292
Great Britain				169,746	174,489
Hungary	20,913			40	4,722,020
Italy	472,223			426	493,164
Latvia				75	561,921
Lithuania	488			267	2,039,091
Netherlands	6,500			9,388	1,517,300
New Zealand				48,545	1,575,382
Paraguay				4,740	4,194,705
Poland	11,542			3,029	33,829,160
Rumania	5,435			1,578	1,137,772
Switzerland	386			132,053	133,784
Uruguay		55,116		180,100	17,622,056
Yugoslavia					178,528
Other countries	16,851			57,669	376,466
Total	795,108	381,620	4,297	3,028,940	140,006,848

Table 11 shows the kind and quantity of foreign meat and meat food products refused entry or condemned on account of unsoundness, presence of prohibited preservatives, mislabeling, defective canning, or other failure to comply with the regulations.

TABLE 11.—*Foreign meat and meat food products refused entry and condemned, fiscal year 1939*

Product	Refused entry	Condemned	Product	Refused entry	Condemned
Beef:	*Pounds*	*Pounds*		*Pounds*	*Pounds*
Fresh		681	Mutton, canned	6	
Cured	324	30,891	Sausage	15,362	25,929
Canned	530,316	32,413	Miscellaneous	1,721	90
Veal:					
Fresh		85	Total	646,298	206,868
Pork:					
Fresh		2,130			
Cured	4,087	62,929			
Canned	94,482	51,720			

FOREIGN ANIMAL CASINGS RELEASED FOR ENTRY OR REFUSED ENTRY

Animal casings from 46 foreign countries were released for entry as follows: On certification, 12,636,351 pounds, of which 90,538 pounds were dried casings; on disinfection, 1,301,672 pounds; total, 13,938,023 pounds. Casings amounting to 3,814 pounds were refused entry and removed from the United States.

INSPECTIONS FOR OTHER AGENCIES OF THE GOVERNMENT

By request of other Government agencies, meat and meat food products were inspected for condition and conformance to specifications as shown in table 12.

TABLE 12.—*Inspections for other Government agencies,*[1] *fiscal year 1939*

Branch of Government	Passed	Rejected	Branch of Government	Passed	Rejected
	Pounds	*Pounds*		*Pounds*	*Pounds*
Navy Department	64,512,435	1,630,746	Maritime Commission	329,534	5,017
Veterans' Administration (hospitals and homes)	7,041,186	154,404	Inland Waterways Corporation	197,313	2,082
Marine Corps	3,542,530	112,079	Tennessee Valley Authority	104,853	1,145
Department of Justice (Federal penitentiaries)	3,463,334	89,379	Public Health Service	23,495	3,984
Department of the Interior:			Department of Commerce		
Alaska Railroad	152,580		(Bureau of Fisheries)	7,006	
Bureau of Indian Affairs	1,109,038	20,369	Panama Railroad Co	3,311	436
Coast Guard	760,928	21,993	Total	81,715,307	2,048,224
War Department (Army Engineering Corps)	467,764	6,590			

[1] Not including inspections for emergency and relief agencies.

EXEMPTION FROM INSPECTION

The provisions of the meat-inspection law requiring inspection usually do not apply to animals slaughtered by farmers on farms nor to retail butchers and retail dealers supplying their customers. Farmers, retail butchers, and retail dealers, however, are required to furnish shippers' certificates, thus providing the Bureau with a record of their shipments. In addition, the retail butchers and retail dealers, in order to ship meat and meat food products in interstate or foreign commerce, are required to obtain certificates of exemption from inspection. During the year 130 of these certificates were issued and 236 canceled. The number of certificates outstanding at the close of the year was 755.

During the year 53,220 interstate shipments were made of meat and meat food products from animals slaughtered by farmers on the farm. The products composing these shipments are shown in table 13.

TABLE 13.—*Shipments of farm-slaughtered meat and meat food products, fiscal year 1939*

Product	Carcasses	Quantity	Product	Carcasses	Quantity
	Number	*Pounds*		*Number*	*Pounds*
Cattle (1,035 quarters)	258	131,628	Cured meats		379,727
Calves	51,369	3,188,384	Lard		2,703
Sheep	4,980	110,044	Sausage		125,539
Swine	300	34,713	Miscellaneous (scrapple, headcheese, livers, souse, meat loaf, etc.)		22,489
Fresh meats:					
Beef		35,477			
Veal		151,645			
Mutton and lamb		2,916	Total	56,907	4,292,709
Pork		109,494			

Retail butchers and retail dealers holding certificates of exemption made 80,776 shipments (table 14).

TABLE 14.—*Shipments by retail butchers and retail dealers under certificates of exemption, fiscal year 1939*

Product	Carcasses	Quantity	Product	Carcasses	Quantity
	Number	*Pounds*		*Number*	*Pounds*
Cattle (2,677 quarters)	669	322,315	Cured meats		1,009,081
Calves	7,754	616,483	Lard		28,056
Sheep and lambs	824	33,092	Sausage		218,921
Swine	429	60,801	Miscellaneous (headcheese, suet, scrapple, compound, etc.)		55,306
Fresh meats:					
Beef		4,382,009			
Veal		462,258			
Mutton and lamb		698,930	Total	9,676	8,502,118
Pork		664,896			

MEAT-INSPECTION LABORATORIES

Chemical analyses and other scientific examinations of meats, meat food products, and of ingredients and substances used in their preparation were conducted in the seven meat-inspection laboratories distributed throughout the country. The number of samples examined was 36,928, of which 4,047 were not in conformity with the regulations.

Adverse findings reported were due principally to excessive water in sausage, excessive dried skim milk in sausage, excessive moisture in smoked meat, failure to declare added substances, inclusion of substances not permitted in preparing meats and meat food products, excessive fatty tissue in pork sausage, and failure to conform with the requirements of the meat-inspection regulations governing the importation of foreign meats. The laboratory reports were utilized by inspectors exercising immediate supervision over establishment operations in the correction of irregularities indicated by the laboratory findings.

LABELING MEAT AND MEAT FOOD PRODUCTS

There were approved 17,041 labels and other markings for use on inspected meat and meat food products at establishments operating under Federal meat inspection, and 527 labels for foreign-prepared

meat and meat food products intended to be offered for entry into this country. A total of 1,803 labels and markings were found to be unacceptable for approval, principally because of the inclusion of statements or designs which were regarded as being false or misleading with respect to the identity, quality, quantity, ingredients, origin, or nutritive value of the products for which intended.

DRAWINGS AND SPECIFICATIONS

There were submitted for examination and approval 658 sets of drawings and specifications for the construction and equipment of new and remodeled buildings and changes in existing structures at meat-packing establishments where Federal inspection is maintained, or at which its inauguration is contemplated. In examining and approving building and equipping projects it is the aim to require means for proper sanitation and facilities for the performance of efficient inspection.

PACKERS AND STOCKYARDS DIVISION

The work of the Packers and Stockyards Division was directed by A. W. Miller, Chief, until October 16, 1938. On this date certain work in the Department of Agriculture was reorganized. This included the transfer of the administration of the Packers and Stockyards Act from the Chief of the Bureau of Animal Industry to C. W. Kitchen, who on July 1, 1939, was made Chief of the Agricultural Marketing Service. The administration of the Packers and Stockyards Act constitutes the work of one of the divisions of the new organization, and the annual report of activities in connection with the administration of that act for the fiscal year ended June 30, 1939, will be published by the Agricultural Marketing Service.

To carry on the remaining activities of the Packers and Stockyards Division, namely, the control of the interstate transportation of livestock and the enforcement of the transportation and quarantine laws, the Interstate Inspection Division was created. This Division is directed by A. W. Miller, and the report on its operation appears earlier in this publication.

PATHOLOGICAL DIVISION

Under the direction of Harry W. Schoening, Chief, the Pathological Division followed the usual lines of scientific investigation of the diseases of domestic animals and birds, the poisoning of livestock by plants, and the examination of viruses, serums, and other biological products used in the treatment and prevention of diseases of domestic animals.

DIAGNOSIS AND CONTROL OF DISEASES

Cooperative work in the control and eradication of glanders in the various States was continued. The complement-fixation test was applied to 93 samples of blood serum from animals suspected of being affected with, or exposed to, the disease. No positive reactions were obtained.

Samples of blood serum from 478 horses in districts where dourine has been present or suspected were subjected to the complement-fixation test, and 2 gave positive reactions. Blood serums from 25 horses, donkeys, and zebras offered for import were tested by complement

fixation for glanders and trypanosomiasis before being admitted. No positive reactions were obtained.

Forty-nine brain specimens from suspected cases of rabies were received and subjected to laboratory examination. Of these, 36 were from dogs, 12 from cats, and 1 from a squirrel. No evidence of rabies was found in any of the specimens.

TESTING BIOLOGICAL PRODUCTS

Cooperating with the Division of Virus-Serum Control, the Pathological Division continued the examination of samples of biological products, cultures, and viruses intended for use in the preparation of veterinary biologics. During the year 491 representative samples of serums, antitoxins, vaccines, bacterins, aggressins, filtrates, and toxoids were tested for purity, potency, and safety. Of these, 320 were approved and 171 were found to be unsatisfactory. Of 189 cultures and viruses examined for conformity to type, 135 were approved and 54 were found to be unsuitable for the preparation of veterinary biologics.

INFECTIOUS EQUINE ENCEPHALOMYELITIS

The Bureau continued its efforts in the collection and dissemination of epizootiological and other data pertaining to infectious equine encephalomyelitis. More cases of the disease were reported than for any previous year, the number of affected animals being 184,662 in 39 States. The general incidence was 23.6 cases per 1,000 horses and mules, and the average mortality in affected animals was 21.4 percent. The mortality in the relatively few cases due to eastern-type virus—90.2 percent—remained high, whereas that resulting from the much greater number of cases affected by the western-type virus was only 19.8 percent.

Virus was recovered and typed by the Bureau for the first time from cases in Florida, Massachusetts, Kentucky, and Illinois. The eastern virus remained confined to the Atlantic States, being found in a number of Massachusetts cases, in 1 from North Carolina, and in 2 from Florida. One of the last-mentioned cases occurred in midwinter, which in the particular locality was mild and favorable to insect propagation and activity. All other strains of virus recovered and typed in 1938 were of the western type. To June 30, 1939, eastern-type virus has been identified in 9 States, namely, Delaware, Florida, Georgia, Maryland, Massachusetts, New Jersey, North Carolina, South Carolina, and Virginia, and western-type virus has been identified in 13 States, namely, California, Idaho, Illinois, Iowa, Kansas, Kentucky, Minnesota, Montana, Nevada, North Dakota, South Dakota, Texas, and Utah.

Clinical and pathological diagnoses only have been made in Arizona, Connecticut, Michigan, New Mexico, and Oklahoma, whereas only clinical diagnoses are known to have been made in Arkansas, Maine, Mississippi, Missouri, Oregon, Rhode Island, Washington, and Wyoming.

Failure to recover virus from tissues collected from clinically and pathologically typical cases not infrequently occurs. The indications are that at least some of the failures are attributable to case selection and the technique of handling the sample tissues. To improve the character of the specimens collected, a mimeographed leaflet on the

subject, together with the annual report on the epizootiology of the disease, has been distributed among veterinary officials.

A western-type strain of virus has been propagated in chick embryos, 1 continuous series (A) through 147 consecutive passages, and 1 series (B) through 119 passages in the embryo interrupted 3 times at intervals of 22 to 33 embryo passages by passage through the horse and guinea pig. Infective titers varied in the same series and in the 2 series when compared from time to time, but there has been no essential difference in antigenic, immunologic, or pathogenic characteristics.

Special attention has been given to encephalomyelitis chick-embryo-tissue vaccine.

More than 300 commercially prepared eastern-, western-, and bivalent-type vaccines, as well as a number of experimental products, were examined with regard to sterility, safety, and efficacy. Most of the testing for potency was carried out on laboratory animals, chiefly guinea pigs. More than 5,000 of these animals were used. The serial lots of vaccine tested would represent approximately 2,000,000 doses for horses.

The commercially prepared products, made for the most part from strains of virus recovered in past years, were found to protect equally well against old laboratory strains and recently isolated strains. Many of the more potent products, of the western type particularly, protected guinea pigs in one 0.5-cubic centimeter or even one 0.1-cubic centimeter dose. In general, the western-type vaccines were found to be more uniformly potent than either the eastern- or bivalent-type vaccines.

In studies of the keeping qualities of the vaccines, some products lost much of their antigenic power when exposed to room or incubator temperatures for 30 days. Others, originally more potent, were more resistant to such exposure. The indications are, however, that vaccines should not be long subjected to temperatures above those of efficient refrigeration if maximum potency is to be maintained. Originally effective vaccines held for 6 months and in some cases 9 months after preparation, at a temperature of 5° to 8° C., were found to be good immunizing agents.

Guinea pigs receiving potent western-type vaccine retained their immunity for 6 to 9 months. Those treated with the eastern-type vaccine showed a reduction in resistance at 6 months, and at 9 months immunity was substantially less than in the beginning.

Nine horses injected with western-type, formolized, chick-embryo-tissue vaccine were exposed in groups of three: one group 3 months, the second 6 months, and the third 12 months, after vaccination. The animals, with three controls in each test, were exposed intracerebrally, receiving 0.5 cubic centimeter of varying dilutions of glycerin-preserved, guinea-pig-brain virus. Two animals in group 1, all in group 2, and two in group 3 survived this severe exposure, to which all controls succumbed. One vaccine tested after 9 months in the refrigerator afforded complete protection to two horses similarly exposed, all the controls succumbing.

Difficulties in maintaining a standard virus for purposes of exposure in immunity tests stress the need for a more permanent virus-tissue preparation. Of the various methods of preservation investigated, drying appears to be the most promising. Activity of one

sample of rapidly and thoroughly dried virus persisted even at 37.5° C. for 60 days.

Studies of complement fixation were continued, use being made of infected chick-embryo tissue as antigen. The tissue was finely ground, preferably in a colloid mill, and diluted in the proportion of 1 part of tissue to 2 parts of physiological salt solution. Some experimental cases of the disease in horses yielded complement-binding serum while the animals were in the acute stages of the disease. Blood-serum samples were obtained 3 to 5 months after the encephalomyelitis epizootic in Wisconsin and Montana. Approximately 20 percent of the samples from horses vaccinated with chick-embryo vaccine gave a positive reaction. About 60 percent of the nonvaccinated, recovered animals and 7 percent of the unvaccinated, nonaffected animals yielded positive serum.

Guinea fowls have been found to be susceptible to both the eastern and western types of equine encephalomyelitis virus injected intracerebrally.

Adult cattle also were found to be susceptible to the intracerebral injection of either type of virus. Those injected with western virus, like calves, as previously reported, tended to recover, whereas the eastern virus produced death in most instances. As with horses, cattle recovering from disease due to one type of the virus were found to be susceptible to the other type.

Adult cattle and goats failed to develop encephalomyelitis when injected intravenously or subcutaneously, and virus was not demonstrable in the blood stream during the usual incubation period for the disease. It appears probable that these animals may be eliminated as interseason carriers or disseminators of the disease during an equine epizootic.

A study was made of ducks that died of a disease resembling so-called western duck sickness, a form of botulism, in Montana. The symptoms somewhat resembled those of experimental equine encephalomyelitis in ducks, and pathology suggestive of that disease was found in a number of cases. The equine virus was not demonstrated, but the epizootic terminated before definite conclusions were made.

PERIODIC OPHTHALMIA

Periodic ophthalmia investigations were continued in an area where veterinarians had reported the disease to be prevalent and on the increase, with the view of studying factors correlated with the disease.

The field investigations were conducted on a sampling basis, inspections being made of all horses and mules on 5 adjoining farms at each 10-mile interval in 12 counties. Of 43 five-farm units inspected, 10 were free of the disease, and 33 had an incidence of 4 to 47 percent of affected animals, most of the cases having developed on these farms. The incidence of the disease in the 12 counties was as follows: 0 to 5 percent, 2 counties; 5 to 10 percent, 3 counties; 10 to 20 percent, 4 counties; and 20 to 31 percent, inclusive, 3 counties.

The following conclusions are the result of this field study of the disease. The incidence of periodic ophthalmia is directly correlated with the density of the horse and mule population. The disease usually makes its appearance sporadically within a community or area, sometimes only one appearance and sometimes several being made over a period of years. The disease will probably spread to areas

now free of the disease, as three of the inspected counties were reported practically free of the condition prior to 1933. During this and the following year, the disease appeared on practically every farm in these counties, the animals now affected being more than 25 percent of the total horse and mule population, estimated at approximately 3,000 cases. The nature of the disease varies from a severe acute type, found where the incidence is highest, to a more chronic type with only occasional attacks once or twice a year, usually found where the incidence is low. The disease usually affects 10 to 50 percent of the animals on a farm.

INFECTIOUS ANEMIA

In continued studies on the distribution of infectious anemia, cases of the disease, as determined by the horse-inoculation test, were found in Pennsylvania and Virginia, thus adding 1 State, Pennsylvania, to the list of 24 States in which the disease has been proved to exist.

Further studies of potential dissemination of the disease by symptomless carriers demonstrated, by horse-inoculation tests, that the blood from two such carriers was still infectious 3 years 2 months and 3 years 7 months subsequent to experimentally induced infection.

Sodium sulfanilyl sulfanilate, one of the many compounds that have been synthesized from sulfanilamide, like the latter drug, was found to have no therapeutic value against the disease. Administration of 550 grams of the drug within a period of 64 hours failed to free an infected horse of the virus of infectious anemia.

Attempts to cultivate the virus of infectious anemia in chick embryos 6 to 15 days old were unsuccessful.

Histological study of tissue specimens from field and experimental cases revealed characteristic pathological alterations in the livers and spleens, a finding which will assist in diagnosing suspected cases that come to autopsy.

SWINE ERYSIPELAS

Tentative standard requirements for the production of commercial anti-swine-erysipelas serums have been established whereby all such serums, before being released in the normal trade channels, must be of such a potency that 0.5-cubic centimeter quantities will protect pigeons against exposure doses of swine erysipelas organisms which kill control birds within 2 to 6 days. Prior to the establishing of such a standard, there was no uniformity in the quality of the product produced by biological houses.

A diagnosis, made by a practicing physician, of swine erysipelas infection in a lobster handler was confirmed in the Division. The culture isolated from the blood stream prior to death and from vegetative growths on the heart valves (similar to those observed in erysipelas infection in swine) following death corresponded in all details to *Erysipelothrix rhusiopathiae*, the causative agent of swine erysipelas. The erysipeloid resulted from foot injury by a fragment of lobster shell.

The production of an antiserum of high potency for swine erysipelas entails a considerable loss of horses. The virulent organisms frequently localize in the joints, causing intense pain and lameness followed by the death of the animals. During the last fiscal year a serum of very high potency has been produced in which rough avirulent strains of the organism have been used instead of the

virulent strains. It is of interest that the horse was inoculated intraperitoneally instead of the organism's being introduced intravenously, as customary. The new practice has been attended with good results, and a serum of high potency has been produced with no ill effects in the horse. This experiment has been repeated with good results.

During the spring of 1937 more than 1,000 pigs in a large herd in which swine erysipelas had been diagnosed were treated with serum (10-cubic centimeter doses) at between 10 and 15 days of age, and were observed, at the time of slaughter as finished hogs, for any evidence of infection with the swine erysipelas organism. No cases of infection were found. Late in the fall of the same year (1937) and early in the spring of the following year (1938) no serum was administered to the pigs, with the result that a large number of the animals had enlarged joints and were culled from the herd. Swine erysipelas organisms were isolated from many of these animals. Pigs from the fall (1938) farrowing and from the following spring (1939) farrowing received two 10-cubic centimeter doses of anti-swine-erysipelas serum, the first dose at 3 to 5 days of age and the second 1 month later. No enlarged joints have been observed in these animals. This finding indicates that the serum may play a large part in preventing arthritis due to swine erysipelas infection. The work will be continued.

ANAPLASMOSIS

Anaplasmosis studies were continued on splenectomized calves and cows. Irregular reactions have occurred in these animals following second inoculations of blood from carriers. Only about 50 percent have shown typical reactions. These animals are thus excluded as dependable test animals for detecting carriers.

A cow that had lost the carrier stage and reacted typically to an injection of virulent blood again lost the carrier state in less than a year from the time of the second injection. The first anaplasmosis infection in this cow occurred in August 1927. She remained thereafter a carrier for about 5 years. The cow died before she could be infected for the third time.

Confirming results of last year, treatment of virulent blood with 0.5-percent crystal-violet solution for 1 hour was again found sufficient to destroy the virus. Six additional animals were injected this year with this treated blood, four of them receiving 100 cubic centimeters each. No reaction followed the inoculation. All six of these animals later proved to be susceptible to anaplasmosis.

In an experiment, 20 cubic centimeters of blood obtained from each of three carrier cows was frozen and dried rapidly under vacuum and was then injected into each of three normal cows. The blood so treated failed to produce anaplasmosis in any of the animals. These three cows were subsequently proved to be susceptible to anaplasmosis. Later, 200 cubic centimeters of blood from a cow having an active case of anaplasmosis was treated in the same manner and injected into a splenectomized cow, but failed to produce the disease. The susceptibility of this cow to anaplasmosis is now being tested.

Two of three calves whose dams had recently been infected with anaplasmosis were shown at the time of their birth to be infected with anaplasmosis. The third calf was proved to be uninfected with

anaplasmosis but susceptible to the disease. Blood from a dead foetus aborted by a cow 3 days before she died of acute anaplasmosis produced an acute, fatal anemia resembling anaplasmosis in a splenectomized calf, but blood from this calf failed to produce any symptoms of anaplasmosis in a normal cow.

Three attempts to produce anaplasmosis with material from chick embryos inoculated with virulent blood have failed.

One cow is still a carrier of anaplasmosis after 12 years.

Several cows were treated with sulfanilamide during the acute stage of the disease. The drug seemed to increase the symptoms and all but one animal died. Blood taken from the cow that survived and one that died produced anaplasmosis in susceptible animals. Five cows, all carriers of anaplasmosis, were treated with large doses of sulfanilamide over a 4-day period, and one cow was treated over a 4-day period twice, 4 months apart. The carrier state was not destroyed in any of the cows treated for one 4-day period, but subinoculations from these treated cows produced in healthy cattle atypical reactions, consisting in little rise in temperature and few marginal bodies. The cow that received the two periods of treatment was still a carrier after the first period and just before the second treatment, but was no longer a carrier 12 days after the last treatment.

MISCELLANEOUS DISEASES

In the course of studies of anthrax biologics, a number of commercial vaccines were examined, found to be unsatisfactory, and were withdrawn from the market. Reports from the field indicate that the intradermic method of vaccination for anthrax is growing in favor and that the results obtained from its use have been satisfactory. These reports agree with the findings of this Division.

A survey of the anthrax-affected territory of South Dakota, where outbreaks occurred in 1937, and reports from Nebraska indicate that the prevalence of anthrax was considerably below normal average for the 1938 season. Although natural causes played an important part in making it an unusually mild anthrax season, there appears to be no doubt that much was accomplished in the way of control by the intensive anthrax-prevention educational campaign which stressed routine preseasonal vaccination, strict quarantine measures, and prompt and proper destruction of anthrax-affected carcasses. No losses from anthrax occurred in 2,556 cattle on Indian reservations in South Dakota nor in 1,800 cattle on Indian reservations in Nevada where routine preseasonal vaccination had been carried out under supervision of Bureau officials.

An outbreak of a disease in a brood of 300 young guinea fowl, resulting in the death of all the birds, was found to be pullorum disease. This is the first report of the occurrence of pullorum disease in the guinea fowl.

A method of preparing uncoagulated whole blood for demonstrating the rapid, whole-blood agglutination test for pullorum disease was developed. Prior to the collection of the blood from the chickens, 1 percent of a 20-percent potassium oxalate solution was placed in the test tube. The blood was kept at a temperature of about 40° F. for approximately 7 days, after which time it was still suitable for the use intended.

Nine specimens of tissues from sheep suspected of being tuberculous were received from establishments operating under Federal meat

inspection. The post-mortem diagnosis of tuberculosis was confirmed in all cases by microscopic tests or animal inoculations. Seven of the nine cases were found to be due to the avian type of tubercle bacillus. The type of tubercle bacillus in the other two cases was not determined.

A number of outbreaks of equine influenza were reported, from one of which a Bureau representative forwarded the laboratory samples of blood taken from three affected horses. The serum from these pooled blood samples was filtered through a Berkefeld N filter. The filtrate, when injected into two normal adult horses, produced uncomplicated equine influenza. The symptoms which these horses showed were anorexia, pyrexia, icterus, and swelling and stiffness in the hind legs. The disease also developed in a normal horse which was placed in contact with the two horses injected with the serum. The duration of the experimental diseases was a little more than 1 week.

A strain of swine influenza virus and two strains of *Haemophilus influenzae* (suis) have been obtained preparatory to experimental investigations of this disease. The virus has been maintained by repeated passages in mice and on embryonated eggs.

In investigations of Johne's disease there has been need of improvement in methods of diagnosis, particularly the development of a more satisfactory johnin, the diagnostic agent. With this purpose in view, further animal-inoculation experiments were carried out with cultures of *Mycobacterium paratuberculosis* incorporated in paraffin oil. Although chickens are difficult to infect, several birds succumbed to inoculation and revealed at autopsy pinpoint lesions on the surface of the liver and spleen with considerable enlargement of the spleen. Inoculated pigeons developed extensive lesions of the abdominal organs, became extremely emaciated, and died in 5 to 6 months. In one pigeon inoculated intraperitoneally, the lesions were largely confined to the pectoral muscles. These experiments add to the number of species of small experimental animals that are susceptible to this manner of inoculation.

INVESTIGATIONS OF STOCK-POISONING PLANTS

Preliminary studies were made of the possible toxic effect of some of the less desirable browse plants growing in the intermountain region when these plants constitute the greater portion of the diet of sheep. It was found that some species of rabbitbrush (*Chrysothamnus*) and snakeweed (*Gutierrezia*), which are usually eaten only under adverse feed conditions, could produce toxic symptoms and might cause death if consumed in excessive quantities. *Malcolmia africana*, which has been suspected of causing sheep losses, was fed without producing any toxic effect.

The study of bighead in sheep was continued and resulted in further confirmation that two species of *Tetradymia*, *T. glabrata* (littleleaf horsebrush) and *T. canescens* var. *inermis* (spineless horsebrush), are the principal causes of range bighead when they are associated with certain predisposing factors of diet and management. It has been shown that the swelling or edema associated with bighead results from the action of light on a sensitized skin and appears to be a true photosensitization.

Investigations on the toxicity of copperweed (*Oxytenia acerosa*) showed this plant to be definitely poisonous to both cattle and sheep and a source of danger to livestock on certain overgrazed trails.

One of the milkweeds (*Asclepias labriformis*) was found to be the most toxic of the known poisonous milkweeds and the cause of considerable livestock loss on certain limited areas.

TOXICOLOGICAL INVESTIGATIONS

Investigations showed that different varieties of sorghum vary considerably in their content of hydrocyanic acid. A paper was published giving the results with 33 varieties of sorghum, some of them for a 2-year period. It was shown that varieties such as feterita, sumac sorgo, chiltex, and hegari ordinarily have a very high hydrocyanic acid content during the whole growing season, whereas Leoti sorgo, African Millet sorgo, and a strain of Dakota Amber sorgo have a comparatively low content. In a study of the iodine test for toxicity in sorghum, no correlation between the reaction and the hydrocyanic-acid content could be found. The quantity of hydrocyanic acid in the common tuliptree was shown to vary at different seasons.

BRANCH LABORATORIES

CHICAGO

The branch pathological laboratory at Chicago, Ill., was engaged, as in previous years, in investigating diseases of meat food animals and aiding the Federal meat-inspection service by rendering diagnoses of obscure or unusual diseases and conditions. The specimens received represented a large variety of diseases and pathological conditions of cattle, calves, sheep, swine, and horses. A total of 791 pathological specimens were received from 49 cities where Federal meat inspection is conducted.

A large number of cases of coccidioidal granuloma were found in the bronchial and mediastinal lymph glands of cattle originating in Texas. A few cases of lung involvement were also noted.

Mushy smoked hams were encountered for the first time. They are similar to the mushy boiled hams which have been found from time to time over a period of years. These mushy smoked hams are so-called tenderized hams which have been artery-pumped and then heated to 140° F. or more. The mushiness of the muscles occurs in those hams that contain a large number of sarcosporidia, the theory being that the heat activates or releases an enzyme present in the sarcosporidia which has a dissolving or digesting action on the muscle fibers. Cut and stained sections prepared from such hams reveal a large number of large sarcosporidia throughout the altered muscle tissue.

DENVER

At the Denver laboratory 8,045 specimens were examined. Of 4,604 cattle tested for Bang's disease, 85 percent were negative, 10 percent positive, and 5 percent suspicious for this disease.

Of 1,239 chickens received, 395 had pullorum disease, 100 were affected with fowl paralysis, 100 proved to be positive for carbon monoxide poisoning, and 45 were afflicted with coccidia. Of 615 turkeys examined, 118 died from carbon monoxide poisoning, 106 had pullorum disease, 47 had blackhead, 18 showed trichomonads, and 14 paratyphoid infection.

Examination was made of 94 silver foxes, of which 15 had paratyphoid infection. Miscellaneous diseases were found in 315 sheep specimens examined.

Further studies were made on arthritis in swine and lambs retained on post-mortem inspection. Of 342 swine specimens examined, 200 proved to be positive for erysipelas. More than 90 percent of the arthritic conditions in swine and lambs resulted from swine erysipelas infection.

A pathological museum, consisting of 230 mounted watch-glass specimens, was installed for display.

REGIONAL LABORATORY, AUBURN, ALA.

Forty-one kinds of media were prepared, inoculated, and observed in an effort to devise a medium satisfactory for primary isolations and johnin production. Two of the media show considerable promise. There was an increase in the volume of growth and a very noticeable uniformity of growth throughout the inoculated flasks, as compared with a lack of uniformity of growth response when the standard synthetic medium employed by the Bureau for tuberculin production was used as a control.

DIVISION OF TICK ERADICATION AND SPECIAL DISEASES

The Division of Tick Eradication and Special Diseases, under the direction of W. M. MacKellar, Chief, conducted the Bureau's cooperative work in the eradication of the cattle-fever tick and in hog-cholera control.

TICK ERADICATION

The eradication of the cattle-fever tick was conducted in cooperation with State, county, and Territorial officials and cattle owners of the South, Puerto Rico, and the Virgin Islands.

At the close of the fiscal year, 226 veterinarians and other Bureau employees were working in cooperation with 132 State and 26 county employees engaged in the project. In addition to these regular employees, other workers furnished under the provisions of the Emergency Relief Appropriation Act were also engaged in various activities connected with this project in Florida, Texas, Puerto Rico, and the Virgin Islands. Under the supervision of the combined forces, 16,987,384 inspections or dippings of cattle and 1,729,261 inspections or dippings of horses and mules were conducted. In Puerto Rico and the Virgin Islands, where the tropical variety of fever tick (*Boophilus annulatus* var. *australis*) is prevalent, it was also necessary to treat the sheep and goats and a few deer on infested premises, and 1,049,219 inspections or dippings of these animals were conducted.

The following areas were released from Federal quarantine as the result of tick-eradication activities: Part of two counties and the remainder of one county in Florida; eight counties, the remainder of four counties, and part of three counties in Texas. The aggregate area of the released territory in continental United States was 10,904 square miles. In Puerto Rico the western one-third of the island, covering an area of 1,243 square miles, was released. At the close of the fiscal year, the area remaining under Federal quarantine in continental United States had been reduced to 2 percent of its original size and is now confined to parts of Florida and Texas. Table 15

shows the progress made in tick eradication since its beginning in 1906 and gives the status of the work at the close of the fiscal year.

TABLE 15.—*Tick-eradication results July 1, 1906, to June 30, 1939*

State	Counties quarantined on—		Counties released to June 30, 1939	Released counties tick-free on November 1—			
	July 1, 1906	June 30, 1939		1935	1936	1937	1938
Alabama	67	0	67	67	67	67	67
Arkansas	75	0	75	68	70	75	74
California	15	0	15	15	14	15	15
Florida	67	6	61	55	58	58	59
Georgia	158	0	158	155	158	158	158
Kentucky	2	0	2	2	2	2	2
Louisiana	64	0	64	24	29	42	54
Mississippi	82	0	82	77	79	82	82
Missouri	4	0	4	4	4	4	4
North Carolina	73	0	73	73	73	73	73
Oklahoma	61	0	61	61	61	61	61
South Carolina	46	0	46	46	46	46	46
Tennessee	42	0	42	42	42	42	42
Texas	198	9	189	127	137	149	163
Virginia	31	0	31	31	31	31	29
Total	985	15	970	847	871	905	929

FLORIDA DEER PROBLEM

Tick infestation of deer has continued to delay completion of this project in Florida. In central Florida, where the 1937 State Legislature authorized the removal of deer from the infested areas in four counties, satisfactory progress has been made with indications that the fever tick in this area can be eliminated within the next year. Encouraged by the results in central Florida, the 1939 Florida Legislature provided the Florida Livestock Sanitary Board with authority to remove deer from the infested areas of Collier and Hendry Counties in the southern part of the State. This work will be undertaken during the next fiscal year but, because of the dense swamps and the extent of the area involved, several years may be required to complete eradiction.

ENTRANCE OF TICK-INFESTED CATTLE FROM MEXICO

In the lower Rio Grande Valley adjacent to the Mexican boundary in Texas, reinfestation occurred on several occasions from stray or smuggled tick-infested animals from Mexico. The natural obstacles which the country in this section offers to control measures make it very difficult to stop this exposure, and no completely effective barrier to these movements has yet been devised.

EMERGENCY RELIEF ASSISTANCE

Tick eradication in Florida, Texas, Puerto Rico, and the Virgin Islands received valuable assistance through the allotment of funds by the Works Progress Administration and the Puerto Rico Reconstruction Administration. This assistance was utilized in Florida to reinspect and check conditions in the released areas and to assist with the deer-reduction programs. In Texas employees of the Works Progress Administration assisted with the inspection and dipping of cattle, and in Puerto Rico and the Virgin Islands dipping vats were

constructed and the dipping program largely carried on with this assistance.

MOVEMENTS FROM QUARANTINED AREAS

In the enforcement of Department regulations governing the interstate movements of cattle and horses from areas quarantined for splenetic or tick fever, 133,334 cattle were inspected or dipped and inspected, for which 3,771 certificates were issued authorizing their interstate movement as noninfectious. Horses and mules to the number of 6,111 were also inspected in the quarantined areas, and 1,156 certificates were issued authorizing their movement from such areas. In connection with these movements, 36 cars were cleaned and disinfected.

HOG-CHOLERA CONTROL

Thirty veterinarians were assigned to the investigation and control of outbreaks of hog cholera and allied swine diseases. Through their visits to farms and attendance at meetings, these Bureau veterinarians had opportunity for 54,991 farm inspections and consultations relating to swine disease with farmers, veterinarians, State officials, and others.

Educational work on this project was continued by veterinarians, who attended 277 meetings at which there was an attendance of 21,779 persons. In their field work Bureau veterinarians continued to emphasize the importance of better sanitation and the correct diagnosis of swine diseases. Demonstrations in the use and efficacy of the serum treatments were given in the treatment of 41,529 hogs. During the year 6,262 outbreaks of cholera were reported to Bureau veterinarians, an increase of 1,401 outbreaks over the previous year. Table 16 summarizes these activities in States where hog-cholera-control work was conducted by the Bureau.

TABLE 16.—*Summary of hog-cholera-control work, fiscal year 1939*

State	Meetings		Farm inspections and consultations	Postmortem examinations	Hogs treated in demonstrations	Outbreaks reported to Bureau veterinarians
	Number	Attendance				
Alabama	4	280	2,414	95	0	52
Florida	1	30	2,691	32	14,194	299
Georgia	4	225	1,860	221	1,903	240
Idaho	9	295	816	66	65	28
Illinois	33	4,963	7,318	672	0	523
Indiana	26	1,860	1,574	51	0	129
Iowa	84	3,784	4,691	400	0	758
Kansas	14	319	747	85	0	67
Kentucky	8	291	5,277	126	1	309
Louisiana	1	40	920	11	4,481	54
Maryland	17	1,669	4,015	165	0	353
Michigan	0	0	1,391	46	96	225
Mississippi	3	17	376	1	156	2
Missouri	1	30	377	7	0	18
Nebraska	4	95	1,028	48	0	122
North Carolina	23	2,076	3,044	56	3,442	264
Ohio	3	440	844	124	0	543
Oklahoma	9	1,658	2,286	50	22	67
Oregon	0	0	45	5	124	6
South Carolina	6	2,135	1,583	34	12,849	420
South Dakota	0	0	1,323	55	78	353
Tennessee	12	666	2,124	271	6	980
Texas	5	245	3,166	41	25	261
Virginia	5	390	3,984	16	153	37
Washington	1	65	793	13	0	13
Wisconsin	4	206	304	54	3,934	139
Total	277	21,779	54,991	2,745	41,529	6,262

TUBERCULOSIS ERADICATION DIVISION

The work of eradicating tuberculosis from livestock was continued in cooperation with States, counties, and livestock owners. Activities for the elimination of Bang's disease and Johne's disease likewise were conducted on a cooperative basis. The work of the Division was directed by A. E. Wight, Chief, and his assistants.

BOVINE TUBERCULOSIS

Most of the bovine tuberculosis work done consisted in the testing of cattle under the area plan. Altogether, 11,186,805 tuberculin tests were applied to cattle. The percentage of reactors was 0.5, which was the lowest degree of infection found throughout the project, which began in 1917. The work was conducted from 46 field stations. The State and Territorial authorities employed an average of about 300 veterinarians throughout the year, and counties employed 162 veterinarians on full time. About 293 veterinarians were employed by the Bureau, including those working at a per diem rate, on a part-time basis, and 126 local helpers were employed to assist them in the field work.

The Federal appropriation for tuberculosis work was $2,803,000, and the combined State, Territorial, and county appropriations were approximately $4,000,000.

The Federal legislation authorizing the work provided that the Federal payment for cattle condemned on account of tuberculosis could not exceed one-third of the difference between the appraised value and the salvage, the maximum to be $25 for grade cattle and $50 for registered purebred cattle. Furthermore, the Federal payment could not exceed the amount paid to the owner by the cooperating State, Territory, county, and municipality. The average appraised value of reactors was $89.01. The average Federal payment was $15.97, and the average State payment $18.96. The owner likewise received the salvage value of the animal. Of the total number of reactors on which Federal payment was made, 5 percent were registered purebred cattle.

At the end of the year 6,372,720 herds, containing 60,439,030 cattle, were under supervision for the eradication of tuberculosis. Table 17 shows that from 1917 to 1939, inclusive, 3,711,858 reactors were removed from the cattle herds of this country.

TABLE 17.—*Tuberculin testing under accredited-herd and area plans, 1917–39*

Year ended June 30	Cattle tested					Modified accredited counties	Yearly increase of—		
	Accredited-herd plan	Area plan	Total	Reactors found and removed			Herds accredited [1]	Herds passed one test [1]	Herds under supervision [1]
	Number	*Number*	*Number*	*Number*	*Percent*	*Number*	*Number*	*Number*	*Number*
1917	20,101		20,101	645	3.2				
1918	134,143		134,143	6,544	4.9		204	883	
1919	329,878		329,878	13,528	4.1		578	5,652	
1920	700,670		700,670	28,709	4.1		2,588	10,064	
1921	1,366,358		1,366,358	53,768	3.9		4,831	33,215	71,806
1922	1,722,209	[2] 662,027	2,384,236	82,569	3.5		8,015	111,719	140,376
1923	1,695,662	1,765,187	3,460,849	113,844	3.3		12,310	150,748	187,915
1924	1,865,853	3,446,501	5,312,364	171,559	3.2	38	19,747	216,737	305,809
1925	2,008,526	4,991,502	7,000,028	214,491	3.1	51	24,110	392,740	414,620
1926	1,989,048	6,661,732	8,650,780	323,084	3.7	109	24,009	382,674	435,840
1927	2,522,791	7,177,385	9,700,176	285,361	2.9	149	34,084	229,086	261,148
1928	2,589,844	8,691,646	11,281,490	262,113	2.3	180	38,880	427,595	473,218
1929	2,853,633	8,830,087	11,683,720	206,764	1.8	213	1,639	249,420	281,323
1930	2,953,350	9,892,521	12,845,871	216,932	1.7	236	11,863	227,921	347,448
1931	3,086,403	10,695,870	13,782,273	203,778	1.5	247	[3] 26,259	350,735	356,916
1932	3,131,426	10,312,131	13,443,557	254,785	1.9	220	18,049	262,988	303,832
1933	2,980,526	10,093,368	13,073,894	255,096	2.0	183	19,701	337,730	346,394
1934	2,826,257	12,293,506	15,119,763	232,368	1.5	189	31,460	342,262	387,969
1935	2,716,292	22,521,240	25,237,532	376,623	1.5	613	13,128	1,324,643	1,276,249
1936	2,193,015	20,725,023	22,918,038	165,496	.7	493	17,119	998,703	924,410
1937	2,274,337	11,475,971	13,750,308	94,104	.7	109	19,688	212,548	230,198
1938	2,598,868	11,510,003	14,108,871	89,359	.6	94	[3] 6,649	[3] 233,268	[3] 273,933
1939	1,578,386	9,608,419	11,186,805	60,338	.5	18	[3] 6,123	[3] 300,756	[3] 98,818
Total	46,137,586	171,354,119	217,491,705	3,711,858	1.7	3,142	262,972	5,734,039	6,372,720

[1] The figures in these columns represent net increases at the close of each year.
[2] Testing during 6 months.
[3] Represents decrease from figures for previous year.

Approximately 86 percent of all the cattle tested were handled under the area plan. Forty-seven States were declared as modified accredited areas on June 30. At the same time the modified accredited area included 3,142 counties. This number included 77 modified accredited areas in Puerto Rico and 3 in the Virgin Islands. More than 99 percent of the counties in the United States were in the modified accredited area at the end of the fiscal year. At that time the nine remaining counties in the nonaccredited State of California were engaged in intensive testing.

AVIAN TUBERCULOSIS

The survey of farm poultry flocks begun several years ago in connection with the testing of cattle for tuberculosis was continued, and 97,836 flocks, containing 10,129,603 fowls, located in 10 States, were observed by the veterinarians in the field. As a result of such observations, infection was reported on 3,315 farms.

As an additional project, about 15 Bureau veterinarians were assigned to the eradication of avian tuberculosis in the Midwestern and North Central States, where the disease is most prevalent. These employees visited 10,856 farms and observed 1,383,305 fowls. They reported infection on 1,812 farms.

JOHNE'S DISEASE (PARATUBERCULOSIS)

The result of tests of cattle for Johne's disease, or paratuberculosis, made with either johnin or avian tuberculin, showed that this disease

existed to a slight degree in 10 States, and 321 cattle, or 9 percent of the total number tested, were condemned on account of it.

TESTING CATTLE FOR INTERSTATE SHIPMENT

Approved veterinary practitioners throughout the 48 States continued to conduct testing of cattle for interstate shipment. On June 30 there were 11,185 veterinarians on the approved list. These men tested for interstate shipment 18,358 lots of cattle, containing 195,156 cattle, of which 0.05 percent reacted to the tuberculin test. Testing done in connection with interstate shipment of cattle is included in the total testing reported in table 17.

BANG'S DISEASE

The work in connection with the elimination of cattle reacting to the test for Bang's disease was continued. The project was conducted in cooperation with the livestock sanitary authorities and the livestock owners and continued to be on a voluntary basis as far as the Federal Government was concerned.

Beginning July 1, 1938, the Federal payment for cattle condemned as reactors to the test for Bang's disease was based on one-third of the difference between the appraised value and the salvage, the maximum to be $25 for grade cattle and $50 for registered purebred cattle. Beginning May 1, 1939, the Federal payment could not be more than the amount paid by the cooperating State, Territory, county, and municipality. The owner received the salvage in all cases. In the States of Delaware, Florida, Illinois, Maine, Maryland, Minnesota, Mississippi, New Hampshire, New York, North Dakota, Pennsylvania, Virginia, Washington, West Virginia, and Wisconsin, the owner received an additional payment from the State for reactors slaughtered prior to May 1, and provisions were made for a State payment for reactors slaughtered during May and June 1939, in the following additional States: Alabama, Arkansas, Georgia, Idaho, Iowa, Michigan, Montana, New Mexico, North Carolina, Ohio, Oregon, Rhode Island, Tennessee, Utah, Vermont, and Wyoming. In no instance does the owner receive from all sources more than the appraised value.

Approximately $4,150,000 was used for making Federal payments to owners for eliminated cattle, and the Federal operating expenses amounted to about $2,520,000. The States expended about $1,129,000 for indemnity in the Bang's disease project during the year, the total expenditure for State indemnity being about $2,700,000 since the cooperative work was undertaken in 1934. For operating expenses the States expended about $500,000, and the total State operating expenses since 1934 have been approximately $2,000,000.

Agglutination blood tests for Bang's disease were applied to 7,591,398 cattle in 724,613 herds. A considerable number of these were retests. Of the total number of cattle tested, 219,165, or 2.9 percent, were declared to be reactors to the test. During the previous fiscal year the percentage of reactors was about 4 percent.

The average appraisal for cattle reacting to the test for Bang's disease was $97.17; the average salvage, $33.97; the average Federal indemnity, $20; and the average State indemnity, $26.09. Of the reactors, 9 percent were registered purebred cattle.

In 22 States testing of cattle for Bang's disease was conducted to some extent on an area basis, the areas consisting of townships and counties. All the dairy and breeding cattle more than 6 months of age had been tested by this method in about 350 counties at the close of the year. This type of work was also conducted in about 80 additional counties. As a result of an inquiry made regarding the number of State-accredited herds in the Bang's disease project, it was found that there were about 70,000 such herds in 43 States.

DIVISION OF VIRUS-SERUM CONTROL

The Division of Virus-Serum Control, directed by D. I. Skidmore, Chief, continued to conduct regulatory and administrative work authorized by the Virus-Serum-Toxin Act. It also administered the marketing agreement for handlers of anti-hog-cholera serum and hog-cholera virus. This agreement was made effective December 7, 1936, by an order of the Secretary of Agriculture.

WORK AT LICENSED ESTABLISHMENTS

At the close of the year supervision was exercised over 74 licensed establishments, distributed among 50 cities and towns in 21 States. At that time also, 36 establishments were engaged in producing only anti-hog-cholera serum and hog-cholera virus, 32 were producing other biologics only, and 6 were producing both classes of products.

Bureau inspectors examined 496,393 hogs and 717 calves intended for use in licensed establishments. Of these, 175 hogs were rejected at the time they were offered for admission, and 33,691 hogs were rejected because of conditions developing later which made them unsuitable for use. The total number of animal inspections was 3,163,452. Bureau inspectors supervised 4,415 potency and 3,730 purity tests of anti-hog-cholera serum and 2,560 purity tests of simultaneous virus.

Special attention was given to establishments producing antiencephalomyelitis serum and encephalomyelitis vaccines. Following the development of the method of growing the encephalomyelitis virus on chick embryos, a considerable number of establishments applied for licenses for the production of encephalomyelitis vaccines. At the beginning of the fiscal year there was but 1 licensed establishment producing the vaccine by the use of chick embryos. At the close of the year 15 establishments were licensed to produce such vaccines. Samples of the vaccine were submitted with each application for license, and no license was issued until the applicant had demonstrated ability to produce consistently a potent and otherwise satisfactory product.

Samples from each batch of *Brucella abortus* vaccine produced by licensed establishments were collected and the product subjected to examination by the Bureau. This procedure resulted in considerable quantities of the vaccine being withheld from the market and destroyed under Bureau supervision and subsequent improvement in the methods used.

Samples of anti-swine-erysipelas serum were collected and subjected to examination and test by the Bureau. These examinations and tests demonstrated a wide difference in the potency of different serials of the product as marketed. It is now required that each

serial of this product be tested on pigeons by the licensed establishments to determine its protective titer. Any serial that fails to protect all the serum-treated pigeons in the test must be withheld from the market.

Intensive study was made of all veterinary biological products with special reference to their derivation, composition, nomenclature, labeling, and the like. The purpose of this study was to insure that labels on containers of these licensed products, as marketed, will not be false or misleading in any particular. This step necessitated rather drastic revision by licensed establishments of the nomenclature, composition, and labeling, particularly for antibacterial serums and mixed bacterins.

OUTPUT OF BIOLOGICAL PRODUCTS

Table 18 shows the quantities of biologics produced by licensed establishments under the Bureau's supervision.

TABLE 18.—*Biological products produced by licensed establishments, fiscal year 1939* [1]

Product	Quantity	Product	Quantity
Anti-hog-cholera serum cubic centimeters	1,092,397,891	Antitoxins:	
Other serums doses	3,323,727	Antivenin doses	288
Hog-cholera virus cubic centimeters	301,982,394	Botulinus and tetanus units	707,359,600
Aggressins doses	5,773,094	Bacterins doses	48,167,227
		Diagnostics do	1,991,167
		Toxins and toxoids do	31,703
		Vaccines do	51,631,007

[1] Detailed information regarding the production of products within these classes will be furnished on request.

PRODUCTS REJECTED

Table 19 shows the quantities of biological products found to be unfit for marketing. Most of them were rejected in the course of preparation, whereas others were recalled from the market and destroyed.

TABLE 19.—*Biological products rejected and destroyed because of unfitness for marketing, fiscal year 1939*

Product	Quantity	Product	Quantity
	Cubic centimeters		*Doses*
Anti-hog-cholera serum:		Fowl-pox vaccine	199,250
From animals found diseased	3,264,067	Mixed bacterin (avian)	5,060
Contaminated and otherwise unfit	1,075,864	Mixed bacterin (bovine)	45,806
Hyperimmunizing virus (hog cholera):		Mixed bacterin (equine)	4,269
From animals found diseased	7,049,005	Mixed bacterin (swine)	2,550
Contaminated and otherwise unfit	773,932	Normal serum	150
Simultaneous virus (hog cholera):		Ovine-ecthyma vaccine	542,800
From animals found diseased	1,246,585	Rabies vaccine	12,218
Contaminated and otherwise unfit	1,092,505	Swine-erysipelas serum	20,150
		Swine-erysipelas vaccine (export only)	31,560
Total	14,501,958	Tetanus toxoid	5,620
		Tuberculin	138,870
	Doses		
Anthrax vaccine	22,948	Total	1,627,687
Blackleg aggressin	1,305		
Blackleg bacterin	2,824		*Units*
Brucella abortus vaccine	76,523	Tetanus antitoxin	425,000
Encephalomyelitis vaccine	383,934		
Fowl-laryngotracheitis vaccine	131,850		

BIOLOGICAL PRODUCTS AND ORGANISMS OR VECTORS IMPORTED

The importation of veterinary biological products from foreign countries continued to be handled in cooperation with the Treasury and Post Office Departments and the Food and Drug Administration of the Department of Agriculture. The following permits were issued: Four regular permits to import biological products under permit for the year; two special permits covering importations of veterinary biological products; and five special permits by the Secretary to import into the United States one shipment, in each case, of organisms or vectors, as defined by amendment 14 to B. A. I. Order 276, effective on and after March 15, 1939.

Forty-five shipments of veterinary biologics were offered for admittance to this country. Upon examination by Bureau inspectors, 42 of these were found to be biologics that had been exported from the United States, which were returned for various reasons. One shipment was refused entry because it was not covered by a permit. The remaining 2 shipments were admitted.

B. A. I. Order 276 was amended effective on and after March 15, 1939, so as to control the importation of organisms or vectors, which may introduce or disseminate any contagious or infectious disease of animals.

PRODUCTS EXPORTED

Table 20 shows the quantities of biological products that were exported. Bureau inspectors issued 547 certificates to accompany shipments of these products to foreign countries.

TABLE 20.—*Biological products exported under certificates*

Product	Quantity	Product	Quantity
Anti-hog-cholera serum cubic centimeters	7,975,750	Antitoxins units	6,536,506
Other serums doses	50,346	Bacterins doses	1,259,467
Hog-cholera virus cubic centimeters	482,370	Diagnostics do	132,230
Aggressins doses	324,468	Vaccines do	1,236,598

SERUM-MARKETING AGREEMENT AND ORDER

At the close of the year 173 handlers of anti-hog-cholera serum and hog-cholera virus were operating under the serum-marketing agreement and order. Of these handlers, 39 were producers and 134 were distributors, 2 of the latter group being known as volume contract purchasers because of their extraordinarily large distribution. Price schedules of each of these handlers are on file in the Division in accordance with the requirements of the agreement and order.

The objective of the marketing agreement and order is to stabilize the serum-virus industry for the purpose of insuring an adequate supply of these products to the hog producer under all circumstances.

ZOOLOGICAL DIVISION

Basic research on animal parasites, testing of control measures, and experiments with drugs and chemicals to discover practical methods of destroying eggs and larvae of parasites in manure and of removing parasites from livestock and poultry were carried out by the Zoological Division, under the direction of Benjamin Schwartz, Chief.

PARASITES OF HORSES

Tests were conducted during cold weather to determine whether steam could be used effectively to kill the eggs and larvae of horse parasites in stable manure at freezing or near-freezing temperatures. The results showed that manure in insulated boxes could be rendered practically sterile, so far as parasite eggs and larvae are concerned, during the winter as well as during the summer. The steaming of manure for destroying eggs and larvae of horse parasites, developed in this Bureau, is being used successfully on several horse farms.

In an attempt to determine whether cold weather influences to any extent the spread of internal parasites of horses, laboratory tests were conducted at the Agricultural Research Center, Beltsville, Md., with the following results: Only a very small proportion of unembryonated horse-strongyle eggs were found to be viable after being exposed to severe freezing temperature for more than 3 months, most of these eggs being nonviable in about 50 to 60 days. It was observed also that embryonation apparently reduced the ability of the eggs to withstand freezing temperatures, and the preinfective larvae were nearly all killed in about 4 days in freezing weather. At a temperature of 36° F. some unembryonated eggs withstood the cold for more than 6 months, but the majority lost their vitality in about 3 months. At this temperature the preinfective larvae survived for relatively long periods and usually exhibited a variable degree of ability to reach the infective stage.

Repeated thawing and freezing of horse manure were apparently fatal to the contained parasite eggs, provided every period of thawing was long enough to permit appreciable development of the eggs and the freezing was of sufficient duration and intensity to kill the developing embryos. Under outdoor conditions, only a very small proportion of eggs yielded infective larvae during the period from December to April. This finding indicates that in the eastern part of the United States, where alternate freezing and thawing occur during the winter and early spring, many of the eggs and larvae of horse parasites are destroyed by weather conditions.

The addition of a bacteriostat to mixtures of horse feces and water containing urea prevented the formation of ammonia; the horse-strongyle eggs present in this mixture were unaffected by the urea. This fact indicates that the ammonium hydroxide evolved through decomposition of urea is responsible for the destruction of strongyle eggs, which occurs when urea is added to horse feces.

PARASITES OF RUMINANTS

TRICHOMONADS IN CATTLE

Experimental work on trichomonad infection in cattle, begun in 1936, was continued. Infection was originally produced in a small experimental herd by means of intravaginal inoculation of virgin heifers with *Trichomonas foetus* obtained from bacteria-free cultures. Subsequently, a bull used to serve these heifers became infected, and this bull has been used for the transmission of these parasites to cows and heifers through coitus. Experimental infections in eight heifers produced the following results: Five heifers had delayed conception, ranging from 3 to 5 months, but calved normally. One heifer developed pyometra and has remained infected for more than 2 years;

during this period oestrum has not occurred in this host animal. One heifer was slaughtered because of failure to breed. One heifer was infected after becoming pregnant, but the pregnancy was not affected by the organisms and terminated normally. In the animals which gave birth to calves, no genital trichomonads could be detected following parturition.

As unipara (producers of one offspring), five of these eight animals were rebred to the infected bull. All the cows became reinfected, but the secondary infections were of short duration, the host animals becoming pregnant without appreciable delay. Four of the cows calved normally, and one aborted in the eighth month of pregnancy with no evidence of trichomonad infection. Two unipara, previously used as controls, received primary infections through coitus with the infected bull. Conception was delayed 5 months in one animal and 8 months in another, thus demonstrating that primary infections are equally injurious to heifers and cows. As bipara, recovered from secondary infections, three of the previously mentioned five cows were each served once by the infected bull. Tertiary infections did not occur, and at the end of the fiscal year these cows appeared to be pregnant. A fourth bipara, which recovered from a primary infection as a unipara, did not contract a secondary infection following coitus with the infected bull. These cases indicate that the immunity conferred by a single trichomonad infection may be either partial or complete. In three cases, partial immunity as a result of one infection appears to have become complete following a second infection of mild intensity during a continuous breeding period.

An experiment was begun to determine whether the immune principle involved is contained in the blood. A heifer calf, 6 months old, was injected intravenously with defibrinated blood from an immune cow. Five injections, totaling 945 cubic centimeters, were given over a period of 10 days. Simultaneously with the final injection, live trichomonads from cultures were introduced into the vagina. Trichomonads were not recovered until 17 days following experimental infection, whereas a control heifer was positive for trichomonads on the third day following infection. Another heifer, 7 months old, was injected intravenously with blood serum from an immune cow. Five injections of about 160 cubic centimeters each were given over a period of 10 days. Concurrently with the fifth injection (June 24, 1939), more than 300,000,000 live trichomonads from cultures were introduced into the vagina of this host animal, and injections of immune blood serum are being continued twice a week. No trichomonads were recovered from this animal to the end of the fiscal year. Trichomonads were present in the vaginal secretions of a control heifer inoculated with an equal number of organisms within 24 hours after the inoculation.

Studies of trichomoniasis in a dairy herd at Beltsville have been continued for the third consecutive year. During the last year, 939 vaginal smears from 182 heifers and cows were examined microscopically and 17 new cases of infection were diagnosed in the cows. No transmission to heifers has occurred in the herd since the adoption of a plan of management whereby the heifers are maintained separately from the cows and are bred only to bulls known to be uninfected. The following additional information was obtained on the

transmission, immunology, and location of trichomonads in the genital tract: (1) In three cases transmission occurred after artificial insemination with semen from an infected bull; (2) in six cases infection occurred in cows known to have been infected at least during one previous breeding period, two of these cases being unipara, one a bipara, two tripara, and one a quadripara; (3) in a cow slaughtered because of failure to conceive, post-mortem examination revealed trichomonads in the vagina but not in the uterus, neither of these organs showing evidence of pathological alteration; (4) in a bull known to have been infected for 1½ years, post-mortem examination of the genital organs showed trichomonads in the prepuce but not in the urethra, visa deferentia, and seminal vesicles.

ANAPLASMA

Attempts to transmit anaplasmosis by ticks were carried out as follows, use being made of the tropical horse tick (*Dermacentor nitens*) as a vector: Adult ticks were allowed to engorge on a bovine exhibiting clinical symptoms of anaplasmosis. The immature and adult progeny of these ticks were allowed to engorge on cattle in two closely controlled experiments, with negative results. The susceptibility of the animals used for this purpose was later tested by injecting virulent blood into them. The animals became positive for *Anaplasma* following the injection of this blood, thus showing that they were susceptible to the disease and that the failure to transmit it by ticks was due to the noninfectivity of the ticks rather than to the resistance of the hosts.

In order to facilitate the study of anaplasmosis, it is essential to find a small mammal to which the disease may be transmitted. With this object in view, blood from a bovine showing clinical symptoms of anaplasmosis was injected into guinea pigs, rabbits, and white mice. These animals exhibited no clinical symptoms of anaplasmosis, and microscopic studies of their blood failed to reveal the causative organisms. These investigations are being continued.

COCCIDIA

Investigations on coccidia, conducted in the Regional Animal Disease Research Laboratory at Auburn, Ala., showed the presence of nine different species in calves, four of these species being new to science. The course of natural infection with coccidia was followed in seven calves, and it was noted that these animals developed significant infections between the third and sixth week of life. After the infection was maintained at rather high levels for 2 to 4 weeks, as judged by the discharge of oöcysts, it subsided, but some of the organisms were retained and oöcysts continued to be discharged in relatively small numbers. The species *Eimeria zurni* was recovered in large numbers from two calves having a bloody diarrhea. Experimental infection with *E. auburnensis*, one of the new coccidial species discovered, showed that this parasite produced a profuse diarrhea, the feces being slightly tinged with blood. From the ninth to the thirteenth day following infection, the diarrhea was pronounced, although there was as yet no evidence of infection that could be discovered by microscopic examination of the feces. Oöcysts were

abundant in the feces from the twenty-fourth to the twenty-seventh day after infection. It was determined also that the less pathogenic species of coccidia, when they coexisted in the same host, produced a severe diarrhea and emaciation in calves.

LIVER FLUKES

Research on the common liver fluke (*Fasciola hepatica*) and its snail intermediate hosts was initiated in the vicinity of Logan, Utah. A preliminary survey revealed a high incidence of this parasite in cattle in that locality as shown by the following facts: Of 2,364 cattle slaughtered in the local abattoir, the livers of 867 were condemned because of fluke infestation. The loss in this instance, based on an average weight of 11 pounds per liver valued at 12 cents per pound, was $1,144.44. A stury of the snail population on pastures in the locality revealed 4 potential intermediate snail hosts, namely, *Fossaria modicella*, *F. parva*, *Stagnicola caperata*, and *S. proxima*. Two additional snails (*Lymnaea stagnalis wasatchensis* and *Fossaria modicella rustica*) have been shown, under laboratory conditions, to serve as intermediate hosts of the liver fluke. The distribution of the snails was not general over the area, a fact which indicates that even though the pastures are low and boggy the foci of infection are probably limited to relatively small areas.

CESTODES

Four 5-month-old lambs were given, by mouth, cysticercoids of the broad tapeworm (*Moniezia expansa*) the infective larvae having been obtained from oribatid mites collected on sheep pastures in the vicinity of Beltsville. Three of the host animals became infected, the eggs of the tapeworm appearing in the feces of these hosts about 40 days after infection. Except for mild digestive disturbances, evidenced by the passage of soft feces instead of the usual fecal pellets, the infested animals showed no clinical symptoms but gained somewhat less weight than the uninfested controls. This work is being continued in order to determine whether lambs becoming infected early in life develop symptoms attributable to the infestation. Since oribatid mites serve as intermediate hosts of sheep tapeworms, studies were made to determine the ecology of these mites with a view to developing control measures. The mites were found on pastures throughout the year, but they were most abundant from March until September and were especially prevalent in August. Of 1,373 mites collected in August, 294 were found to be infested; of 21 mites collected in September, 11 were found to be infested. The mites occur on grass and in the soil to a depth of at least 2 inches. The available evidence indicates that the reproductive cycle of these intermediate hosts extends from March until September.

Investigations on *Taenia hydatigena*, a tapeworm occurring as a cysticercus in the abdominal cavity of sheep and swine and as an adult in the intestine of dogs, showed that sheep became severely affected in cases of heavy infestation, developed a high fever, and succumbed to the effects of this parasitism in a number of cases, death resulting apparently from injuries produced in the lungs by the migrating larvae. The liver was found to be the preferred location of

the young larvae, but the muscles were not invaded. Several natural infestations in sheep, comparable in severity to those produced experimentally, so far as liver lesions are concerned, were discovered in a federally inspected slaughtering establishment. Since the early developmental stages of these larval tapeworms bear but little resemblance to the fully developed cysticerci, the investigation not only has served to clear up the essential facts in the life history of this parasite, but also has made it possible to diagnose correctly a pathological condition in sheep encountered in the course of meat inspection.

NEMATODES

Since it is well known that heavy infestations with stomach worms are fatal to sheep, investigations were undertaken to determine the precise cause of death in order to obtain a rational basis for treating the symptoms in severe infestations. Of 16 lambs experimentally infected with the common stomach worm, 4 died as a result of the infection, and the remaining ones showed symptoms of varying severity. The effects of the experimental infections were measured by blood counts, red-cell-volume and hemoglobin determinations, and qualitative and quantitative determinations of blood in the feces.

By this technique it was determined that in the fatal cases the lambs lost a considerable portion of their total volume of blood during a 2-week period. The blood loss resulting from stomach-worm infestation was compared with that due to daily withdrawal of measured quantities of blood from the jugular vein. The results showed that the effect of stomach-worm infestation is similar to that resulting from bleeding from the source mentioned. It is evident, therefore, that the anemia produced by stomach-worm infestation in lambs must be considered as being due directly to hemorrhage in the fourth stomach.

The method by which this hemorrhage is produced has not been definitely ascertained, but the available evidence indicates that in lambs dying from stomach-worm infestation considerable destruction of the mucous lining of the fourth stomach occurs, which leads to capillary hemorrhage. Blood was found in the feces of the experimentally infected lambs from 6 to 10 days after the larvae had been administered and several days before the worms had reached the stage of egg production. Since no diarrhea was observed in the experimentally infected animals, it is possible that diarrhea in lambs associated with worm infestation may be due to parasites other than stomach worms.

Since farmers and stockmen are vitally interested in knowing how long a pasture previously occupied by sheep retains infective eggs and larvae of sheep parasites, an experiment was performed to throw light on this problem. It was ascertained that, in general, the infective larvae of common stomach worms, as well as related nematodes occurring in the small and large intestine, did not survive on a pasture more than 3½ months during the summer. The results indicate also that a small proportion of the infective larvae of the lesser stomach worm and related worms belonging to the genus *Trichostrongylus* may survive winter conditions in the vicinity of Beltsville.

An investigation dealing with the differentiation of the eggs of the many species of roundworms that parasitize sheep was completed, and the results were submitted for publication. They should be of great

value to veterinarians, laboratory workers, and others in determining by fecal examination the kind of parasites present in sheep.

In the Regional Animal Disease Research Laboratory at Auburn, a preliminary survey was made to determine the incidence of gastrointestinal parasites in cattle. All the common parasites reported from cattle elsewhere in the United States were found in cattle in that area, *Haemonchus contortus*, *Cooperia punctata*, and *Ostertagia ostertagi*, all known pathogens, being the most abundant. Young animals showing clinical symptoms of parasitism, particularly anemia, recovered when they were removed from the source of infection and fed an adequate diet. In order to test the longevity of infective larvae of certain gastrointestinal parasites, young parasite-free calves were grazed for 1 month on well-drained hillside pastures that had not been grazed by cattle for several months. Under these conditions the calves became infested with various nematodes 3 to 4 weeks after exposure. The lungworm (*Dictyocaulus viviparus*) and the small threadworm (*Trichostrongylus colubriformis*) were not encountered in calves placed on the pasture as early as 43 days after infested cattle were removed early in August. Control calves on a similar pasture continually contaminated by infested animals acquired infestations with these two species during the period that the test calves remained negative.

ARTHROPODS

An experiment conducted in Colorado for about 2 years to determine the effects of ox warble infestation on beef production was completed. One lot of 16 cattle was held in a fly-tight, screened enclosure, and another lot of 18 cattle of similar type, age, and weight was held in an adjoining unscreened corral. The results show that the cattle which were protected from the ox warble flies made an average gain of 550 pounds as compared with 514 pounds for those exposed to the attacks of the flies.

Experiments to determine the effects on ox warble of washes containing derris powder, cube powder, and rotenone were continued in Colorado. Results show that washes made in the proportion of 1 pound of derris powder or 1 pound of cube powder (containing 4 or 5 percent of rotenone), 4 ounces of white-flaked soap, and sufficient water to make 1 gallon, were very effective in killing warbles in the backs of cattle. Washes containing 12 ounces of derris or cube powder were about as effective as those containing 1 pound to a gallon. The cattle were infested with the common species of ox warbles (*Hypoderma lineatum*). The findings indicate that one treatment may free cattle of the common species of warble, but treatment should be applied every 21 to 30 days as long as live warbles continue to appear in the backs of cattle.

Experimental work on treatment and control of grub in the head of sheep was continued in New Mexico and Texas. Of the various preparations sprayed into the nasal passages of sheep to test their effects on the larvae and on the host animal, a 3-percent solution of a saponated solution of cresol was the most effective. The solution was forced into the nasal passages from tanks in which air pressure was maintained at 35 to 45 pounds. Approximately 2 fluid ounces of the 3-percent solution was used on each sheep. One gallon of the

concentrated product made sufficient solution to treat about 2,000 sheep.

The effectiveness of this treatment on range sheep was verified by marking for identification 30 lambs raised and treated with the range sheep. An equal number of lambs were not treated and served as controls. The treated and untreated lambs were slaughtered for the local market from time to time. After slaughter, examinations were made of the head cavities and the larvae present were counted. The untreated lambs had an average of about 22 larvae per animal and the treated lambs, about 3 larvae. It was concluded that the treatment killed about 90 percent of the larvae in the head cavities of the treated sheep.

Results of a cooperative experiment with 210 feeder lambs owned by the New Mexico State College of Agriculture, Las Cruces, N. Mex., showed that lambs treated with the above 3-percent solution did not gain so much in a period of 81 days as untreated lambs. Irrespective of other factors which may have influenced gain in weight, it was concluded that it was not necessary or economical to treat feeder lambs with the solution, for the destruction of grubs, when the lambs are to be finished for market in sections where the winters are cold.

Experiments with fused-bentonite-sulfur (sulfur, 30 percent; bentonite, 70 percent) were continued in New Mexico. The results indicate that one dipping eradicated sheep ticks.

The effects on sheep ticks of feeding medicated salt to infested sheep were tested on one flock in New Mexico and two flocks in Colorado. The formula for the medicated salt used in Colorado was common salt, 100 pounds; sulfur, 3 pounds; soda, 2 pounds; and turpentine, one-half pint. One infested flock in Colorado was fed the medicated salt every other day for 90 days. At the end of the test there were more ticks on the sheep than at the beginning. One infested flock had access to the medicated salt at all times for 70 days. The number of ticks on the sheep increased during the test period. One tick-infested flock in New Mexico had access to salt medicated with turpentine. The sheep did not eat the salt containing more than 1 fluid ounce of turpentine to 3 pounds of salt. At the end of about 75 days the animals had as many ticks as at the beginning of the test. The conclusion is warranted, therefore, that feeding medicated salt to infested sheep as described was of no value in reducing the number of ticks on these host animals.

Results of limited experimental work in New Mexico indicate that fused-bentonite-sulfur dip did not eradicate cattle lice and had no deleterious effects on cattle grubs.

A large number of cattle were inspected for demodectic mange and some cases were found. Often the lesions are not visible, especially when covered by the winter hair coat. Cases are being assembled at San Angelo, Tex., and Colorado Springs, Colo., for experimental studies on the mode of transmission, symptoms, and treatment.

PARASITES OF SWINE

PROTOZOA

A study on the intestinal ciliated protozoan parasite (*Balantidium coli*) showed that suckling pigs may acquire this infection at the age of 1 to 2 weeks. The production of the parasite cysts is appar-

ently associated with the presence of solid material in the feed, cysts ordinarily not appearing in the feces until the pigs begin ingesting solid feed. Heavy infections were associated with frequent attacks of diarrhea, which were of short duration. Infected pigs maintained on a diet of cow's milk were freed from the infection in 8 to 16 days but became reinfected 6 to 29 days after the diet was changed to include solid feed.

Experimental infection of 4- to 8-week-old pigs with coccidia belonging to the species *Eimeria debliecki* and *E. scabra* showed that the incubation periods of the two species are 6 and 9 days, respectively. In the absence of reinfection, the duration of the infection was less than 3 weeks, the outstanding symptom being marked emaciation.

TRICHINAE

Nearly 2,300 diaphragms from as many farm-raised hogs reported to have been fed principally on grain were examined for trichinae. Only 0.52 percent were found to be infected, the number of larvae in individual diaphragms ranging from 1 to about 185,000. Of nearly 1,000 diaphragms obtained from as many hogs fed cooked garbage, none were infected. These data show that only a very small proportion of grain-fed hogs acquired trichinae from one source or another, and that cooking of garbage before it is fed to hogs prevents the spread of trichinae to these hosts. In tests with meat food products customarily eaten without cooking, slightly more than 1,600 samples containing pork muscle tissue processed in the usual manner under Federal meat inspection for the destruction of trichinae, were examined for these parasites by the digestion technique. Only 6 were found to contain dead trichinae, the remaining samples being entirely free from these parasites. This finding indicates that processing under Federal meat inspection is effective for the purpose indicated. A total of 33 samples of pork food products prepared and processed in various foreign countries for the destruction of trichinae and offered for importation into the United States were examined for trichinae with negative results.

Numerous articles appeared in the daily press and elsewhere incriminating frankfurters as a cause of human trichinosis. Data collected by this Bureau showed, however, that of nearly 1,200 ½-pound samples of frankfurters processed under Federal meat inspection, none contained live trichinae and only 11 contained 1 or 2 dead trichinae. This finding shows that special processing under Federal meat inspection protects the public from the danger of acquiring trichinosis from frankfurters, the yearly per capita consumption of which is about 35.

The investigation to determine the effects, on the vitality of trichinae, of the exposure of infested pork to temperatures of −10° and −20° F. was completed. The preliminary results on the periods of exposure necessary to accomplish the destruction of the vitality of trichinae, given in last year's report, were verified, in the main, during the current fiscal year. The information provides a basis for shortening the present period of refrigeration of pork at low temperatures.

Numerous tests were made with various antigens to determine the possibility of detecting, by a skin test, trichinae in live hogs immediately before slaughter. In a small number of tests carried out in

a hog-slaughtering establishment, one antigen, so prepared that it contained suspended particles of finely powdered trichinae, gave positive results in 80 percent of the trichina-infected hogs tested. Only the very slightly infected hogs escaped detection by the use of this new antigen.

LUNGWORMS

In studies on swine lungworms it was determined that the eggs remained viable outdoors for 3 years on moist soil, and that earthworms were able to retain the infective larvae in a viable condition for a similar period. At comparatively low temperatures (17.6° to 24.8° F.) the eggs retained their vitality for 111 days. A large proportion of the eggs in swine feces buried outdoors to a depth of 4 to 8 inches were still viable after 300 days. These observations are of special significance in view of the recent discovery made by a scientist of the Rockefeller Institute regarding the role of swine-lungworm larvae as vectors of the virus of swine influenza. If the virus of this infectious disease is present in the larvae, it must also be present in the eggs, and the observations here recorded tend to throw light on the possible persistence of the virus of swine influenza in both the eggs and larvae of swine lungworms.

Results of experimental infection of pigs with lungworms showed that these host animals are more susceptible to this infection when the stomach is empty than at other times. This finding suggests the desirability of feeding pigs in the morning before they graze, since lungworms are acquired by swine only as a result of ingesting infested earthworms in yards, pastures, and other places where these annelids are present.

THORN-HEADED WORMS

Of various groups of lamellicorn beetles subjected to infestation with the larval stages of thorn-headed worms of swine, only the grubs of the true June beetles (*Lachnosterna*) were found to be capable of surviving the infection. The development of the parasites in the beetle is rather slow, and somewhat more than 12 weeks are necessary for the larvae to attain the stage that is infective to hogs. Optimum temperature for the development of the parasite larvae in the beetle grubs is about 70° F. When the temperature is below 50° F. development ceases but is resumed when the temperature rises. This finding indicates that the development of the parasites in grubs infected late in summer is probably suspended during the winter months and completed the following spring. The parasites survive pupation of the grubs and metamorphosis of the pupae into adult beetles, the development of the parasites being accelerated during these transformations. Adult beetles apparently continue to harbor the preinfective and infective stages of thorn-headed worms and, therefore, constitute a potential danger to hogs which swallow the infested beetles.

KIDNEY WORMS

Severe infestations with kidney worms were found in swine in eastern Indiana. The available evidence shows that this parasite has become established in that State as a result of the importation of infested swine from the South. Kidney-worm infestation was also

reported from southeastern Nebraska. Fortunately, effective methods of controlling this pest by sanitation have been developed by this Bureau, and the possible spread of the swine kidney worm in the Middle West can be checked by approved methods of sanitation.

COMPARISON OF SANITATION AND NONSANITATION IN SWINE PRODUCTION

In cooperation with the Animal Husbandry Division, tests were made to determine the effects of keeping pigs on clean ground as compared with using pastures previously occupied by hogs and, therefore, contaminated with parasite eggs and larvae. In general, the parasitic infestation of pigs raised on clean ground was less severe and of shorter duration than that of pigs raised on contaminated ground. That the heavier parasitisms exerted a harmful effect on the pigs is shown by the following: Approximately 14 percent more feed was required to produce each pound of weight in pigs on contaminated ground than in pigs on clean ground. These facts show that severely parasitized pigs take a considerable part of the profit out of swine production.

PARASITES OF POULTRY

PROTOZOA

Experimental studies on the life cycle of the coccidium (*Eimeria acervulina*) showed that 1½ hours after the ingestion by chicks of oöcysts, the spindle-shaped infecting bodies (sporozoites) originally contained within the cysts were free in the lumen of the duodenum. Within 54 hours after experimental infection, the sporozoites were present in the epithelial cells lining the intestine and 16 hours later evidence of their multiplication was apparent. Three days after infection the new generation of organisms had penetrated other epithelial cells, the general developmental history being essentially similar to that of *E. tenella*, a pathogenic coccidium of chicks which produces intestinal hemorrhage and death.

In cooperation with the Animal Husbandry Division, experiments are in progress to determine whether trichomonads in turkeys can be controlled by raising the body temperatures of the bird hosts above normal. A specially built box equipped with moisture and temperature devices was used to produce the feverish condition in the birds. By heating the box to a temperature of 104° to 106° F. and maintaining a relative humidity of 90 percent, it was found that the parasites in the birds were killed and no deleterious effects were produced on the host by the heat treatment. A second and, sometimes, a third treatment had to be given to free the birds completely of the parasites. Untreated control birds lost weight and frequently died, the mortality being as high as 55 percent in one experiment. Treated birds usually gained weight and lost their infections, if the treatment was adequate. Although some deaths occurred among the treated birds, they were negligible as compared with those in the controls.

CESTODES

It was determined by experimentation that the larvae of meal beetles are susceptible to infection with the cysticercoids of the poultry tapeworm (*Raillietina cesticillus*). Pupae and adults of these insects

infected as larvae were found to harbor the cysticercoids of the tapeworm mentioned and were capable of infecting chickens to which they were fed. These results indicate the importance of keeping chicks away from areas where feed contaminated with meal beetles is stored and of not giving such feed to chicks. It was determined that *R. cesticillus* is capable of establishing itself in birds already infected with this tapeworm thereby explaining the heavy infestations frequently encountered in chickens kept under natural conditions.

NEMATODES

Since no satisfactory medicinal treatment for the removal of gapeworms from chickens and turkeys had previously been discovered, and since these parasites are rather easily acquired through contaminated feed and through the ingestion of infested earthworms, experiments were undertaken to determine whether gapeworms could be removed from the windpipe of their hosts through some means other than by the customary mechanical methods involving individual handling.

A large number of chemicals in the form of dusts were tested, and it was determined that barium antimonyl tartrate inhaled by chickens and turkeys in the form of dust was highly effective for dislodging these parasites. About 1,125 chicks and 236 turkey poults were subjected to this treatment, the average efficacy being 92 percent for the removal of gapeworms from chicks and 96 percent for the removal of these parasites from turkey poults. In order to determine whether a large number of birds can be treated at one time, a galvanized-tin box, 29 inches long, 28 inches wide, and 18 inches deep, was constructed. The box was provided with a solid movable lid except for a 6-inch hinged flap at one end which permitted the insertion of a dust gun for spreading the powder throughout the box. It was determined that fifty 1-month-old birds could be treated at one time in a period of 20 to 30 minutes, the amount of the chemical needed for this purpose being 30 grams.

Following treatment, infested birds coughed or gaped and were mildly depressed for a few hours. When these symptoms disappeared improvement was noted, coughing ceased, and the birds returned to normal. Post-mortem examination of the treated birds, usually 7 days after treatment, showed that the severely inflamed trachea, characteristic of gapeworm infestation, had cleared up as a result of the removal of the worms by the inhalation of the powder. The Department obtained a patent for the use of this chemical by the poultry industry of the United States.

MISCELLANEOUS PARASITES

A species of *Strongyloides* obtained from a naturally infested dog was transmitted experimentally to several dogs to determine the effects of the parasites on the health of the canine host. Preliminary observations indicate that the species of *Strongyloides* affecting canines has a life cycle similar to that of the species occurring in swine. Of the nine dogs infected experimentally, the only visible effect was an intestinal disturbance in one animal.

Material obtained from deer that were slaughtered in Florida in connection with the tick-eradication program revealed a number of

parasites which are known to occur in domestic animals. These parasites included rumen flukes, the large American liver fluke, the common stomach worm of ruminants, and several other economically important parasites.

Morphological and taxonomic studies of trematodes resulted in the preparation of several papers containing descriptions of about 20 new species and 4 new genera.

TREATMENT FOR THE REMOVAL OF PARASITES

The efficacy of 150 preparations for the removal of tapeworms from poultry was tested critically on 400 chickens experimentally infected with *Raillietina cesticillus*. In 10 birds tin oleate proved to be 82-percent effective when administered at a dose rate of 2.5 grams per bird. In 10 birds the efficacy of stannous oxide hydrate was 60 percent when administered at a dose rate of 1 gram per bird. A mixture containing 0.25 to 2 grams of tin oleate and 0.1 to 0.5 gram of synthetic isopelletierine hydrochloride per bird removed all tapeworms from 9 birds. A mixture containing 300 milligrams of tin tartrate and 70 milligrams of synthetic isopelletierine hydrochloride per bird removed 76 percent of the tapeworms from 10 chickens. Lead arsenate at a dose rate of 300 milligrams per bird removed all the tapeworms from 10 chickens, each of which had been experimentally infected with 50 cysticercoids of the species named. In all the tests given above, the chickens were deprived of feed for 18 hours before treatment and 4 hours after treatment.

Experiments with commercial phenothiazine as an anthelmintic showed that at a dose rate of 0.5 gram per pound of body weight, this chemical removed, from 8 sheep, 91 percent of the nodular worms, 76 percent of the hookworms, 100 percent of the lesser stomach worms (*Ostertagia*) and at least 80 percent of the common stomach worms. As this large dose was too bulky to be administered in capsules under farm or range conditions, and as smaller doses proved to be ineffective, the drug was recrystallized to remove impurities and administered at a dose rate of 0.2 to 0.25 gram per pound of body weight. The recrystallized drug removed, from 11 sheep, 90 percent of the nodular worms, 70 percent of the hookworms, more than 33 percent of the lesser stomach worms, 100 percent of the common stomach worms, and 65 percent of the nematodes belonging to the genus *Chabertia*. The therapeutic dose was not only effective but was also nontoxic to the host animals. From the available evidence phenothiazine has a higher efficacy for the removal of roundworms from sheep than any other drug previously proposed for this purpose.

Commercial phenothiazine mixed with feed so that it was consumed at a dose rate of 0.5 gram per pound of body weight removed, from 11 pigs, 79 percent of the large roundworms and 96 percent of the nodular worms. Recrystallized phenothiazine administered in soft gelatin capsules at a dose rate of 0.1 gram per pound of body weight removed, from 10 pigs, 42 percent of the large roundworms and 94 percent of the nodular worms. A herd of 40 hogs was treated with an average dose of 0.5 gram of commercial phenothiazine per pound of body weight, the drug being administered with the feed. The treated animals showed marked improvement in general condi-

tion. As the effective therapeutic dose of phenothiazine is far below its toxic dose, this treatment should be of great aid to hog growers, particularly as regards its efficacy in the removal of nodular worms.

INDEX CATALOG AND COLLECTIONS

The index catalog of medical and veterinary zoology was maintained in its various forms, 42,938 cards being added to the author, subject, and host catalogs and check lists of specific and subspecific names. This represents an increase of approximately 10,000 cards over the number for the previous year. The C section of the author catalog was issued, and the D section was sent to the printer. The E–F section is in the process of preparation.

Of the 875 specimens added to the helminthological collection, 797 were entered under the Bureau of Animal Industry's collection and 78 in the collection of the United States National Museum.

U. S. GOVERNMENT PRINTING OFFICE: 1939

For sale by the Superintendent of Documents, Washington, D. C. - - - - - Price 10 cents

Report of the Chief

of the

Bureau of Biological Survey

1939

REPORT OF THE CHIEF OF THE BUREAU OF BIOLOGICAL SURVEY, 1939

UNITED STATES DEPARTMENT OF THE INTERIOR,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., August 31, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith the report of the Bureau of Biological Survey for the fiscal year ended June 30, 1939, the last of its series of 54 annual reports as a unit of the Department of Agriculture.[1]

Sincerely yours,

IRA N. GABRIELSON, *Chief.*

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[1] The Bureau of Biological Survey was transferred to the Department of the Interior, effective July 1, 1939 (Public Res., No. 20, 76th Cong.—approved June 7, 1939), in accordance with the President's Reorganization Plan No. 11, submitted to the Congress on May 9, 1939, pursuant to the provisions of the Reorganization Act of 1939 (Public, No. 19, 76th Cong.—approved April 3, 1939). This organization was established for wildlife research in the Department of Agriculture on July 1, 1885, as the Section of Economic Ornithology, Division of Entomology; the following year it became the Division of Economic Ornithology and Mammalogy (abbreviated in 1891 to Division of Ornithology and Mammalogy); on July 1, 1896, it was designated the Division of Biological Survey, and 9 years later the Bureau of Biological Survey.

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INTRODUCTION

The work of the Bureau of Biological Survey was signalized during the fiscal year 1939 by the beginning of operations under the Pittman-Robertson Act of 1937 (50 Stat. 917), which authorizes financial aid to the States in their wildlife-restoration projects; by substantial progress in the waterfowl-restoration program, through the establishment, reconditioning, and development of national wildlife refuges and their increased value to migratory birds; and by the dedication of a national wildlife-research refuge on the Patuxent River, within a short distance of the National Capital—the first national wildlife experiment station of a general nature.

FEDERAL AID TO STATES

The Federal Aid to Wildlife Restoration Act, which became effective on July 1, 1938, authorized operating appropriations of not to exceed the annual revenue from the 10-percent tax on sporting arms and ammunition. Collections from this tax for the fiscal year 1939 have thus far totaled $2,976,019. The initial appropriation to the Bureau was $1,000,000, to be matched by about $300,000 of State funds; and for the coming fiscal year $1,500,000 has been appropriated. The act requires the States to submit full information regarding their proposed wildlife-restoration projects and, following approval by the Chief of the Biological Survey, acting for the Secretary, to complete them in an acceptable manner. The States will pay not less than 25 percent of the cost of projects that are approved and the United States not to exceed 75 percent.

At the close of the first year, 42 States had enacted the required assenting legislation, 1 had a similar bill pending, and 5 remained ineligible; 37 States had proposed approvable projects. The wide variety of well-considered plans already submitted attests the earnest desire of State conservation authorities to advance the cause of wildlife restoration effectively. The Pittman-Robertson Act has been termed one of the most beneficial measures adopted in recent years for wildlife conservation, probably the most constructive in its class since the passage of the Migratory Bird Treaty Act of 1918.

NATIONAL WILDLIFE REFUGES

The number of national wildlife refuges under the jurisdiction of the Survey reached a total of 260, with an acreage of 13,530,160, an increase of 12 refuges and of nearly 2,000,000 acres. The year saw the major engineering developments completed on many of the 1934–36 acquisition units, so that these additions to the refuge system are now for the first time fully demonstrating their value in the wildlife-restoration program. Attracted by the improved habitat provided, waterfowl and other migratory birds, as well as resident species, are visiting these sanctuaries in ever-increasing numbers, and on many units species long absent or previously unknown there are becoming established as part of the nesting population. The biological reconditioning and the engineering development of both the new and the older refuges are proceeding satisfactorily, the work being furthered by the aid of the Civilian Conservation Corps, the Works Progress Administration, and the National Youth Administration.

PATUXENT RESEARCH REFUGE

The dedication of the Patuxent Research Refuge, Md., on June 3 by the Secretary of Agriculture is significant in its promise of future improvements in wildlife-management practices. There is now available close to the seat of the Government an extensive tract containing forests, streams, and ponds on which qualified biologists can study wildlife and its needs continuously through all seasons of the year. The research will include experiments in game and fur-animal management, manipulation of habitat, studies of the food and cover requirements and of the economic relations of resident species of the vertebrate fauna, investigations of wildlife diseases, propagation of the food plants of wildlife, and production of upland and other game birds under controlled conditions. The experiments are now in progress and will be considerably expanded when laboratories and quarters now under construction are ready for the research personnel. The wildlife investigations at the new refuge are supplemented by related research on big game and other wildlife on the Wichita Mountains Wildlife Refuge, Okla.; by research at fur-animal experiment stations and wildlife-disease research laboratories; and by investigations on waterfowl and other refuges in all parts of the country as an undertaking incidental to their main purpose, which is to provide breeding, feeding, resting, and wintering grounds for migratory birds and other kinds of wildlife.

OTHER FEATURES OF THE YEAR

Other matters of outstanding importance to the Bureau's work are briefly summarized as follows:

ORGANIZATION

Reorganization.—Pursuant to the Reorganization Act of 1939 and in accordance with the President's Reorganization Plan No. II of May 9, the Bureau of Biological Survey was transferred, effective July 1, 1939, to the Department of the Interior.[2]

Game Commission employees.—Recommendations of the Alaska Game Commission and this Bureau resulted in covering positions of Commission employees into the classified civil service.

WATERFOWL RESEARCH

Wintering grounds in Mexico.—Field investigations developed the importance to the migratory waterfowl of the Central and Pacific flyways of wintering grounds in eastern and western Mexico, which extend farther south than was formerly believed.

Breeding grounds in Canada.—Preliminary aerial surveys in northern Canada located a waterfowl-breeding ground of the first magnitude extending about 70 miles along the coast and back into a region rarely visited by white men.

Food of ducks.—The results of studies of the food habits of North American diving ducks and of the principal foods of shoal-water and diving ducks generally, including identification, range, and propagation of the various plants, were published in two technical bulletins.

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[2] See footnote 1, p. 1.

Waterfowl-disease studies.—The positive and negative relations of various types of aquatic vegetation to the production and control of botulism in waterfowl were established.

Predation on nestlings.—Predator-waterfowl relationships studied on national wildlife refuges disclosed the average nesting success to be 60 percent, with most of the losses caused, in order of depredation importance, by skunks, bull snakes, crows, magpies, coyotes, and snapping turtles.

FUR-PRODUCTION INVESTIGATIONS

Census of fur animals.—Arrangements were completed for including in the decennial census, for the first time, questions pertaining to fur-animal production.

Fur-animal reproduction.—Research on reproduction in minks and muskrats yielded important embryological information and facts of practical value, particularly in mink breeding.

Physical properties of fur.—In a study to determine the factors that contribute to the production of fur of superior quality, mounting media were found that revealed the inner structure of the fibers, and the technique, including use of photomicrographs, developed results of practical application.

Fur-animal disease control.—Large-scale vaccination on fur farms and other methods of immunization, notably against distemper, proved of protective and financial value.

OTHER WILDLIFE STUDIES

Birdbanding.—Nearly 500,000 game and other birds were banded, bringing the grand total to more than 3,250,000, from which more than 200,000 return and recovery records are now available for study.

Attwater's prairie chicken.—A comprehensive study was completed in Texas of Attwater's prairie chicken, which is threatened with the fate of its extinct, close relative, the heath-hen; the results will be published in the North American Fauna series.

Quail-nutrition research.—Cooperative studies of the nutritional requirements of bobwhite quail and the chemical and mineral composition of their important foods were begun, to provide a basis for feeding in captivity and improving native ranges.

Food of ruffed grouse.—In a published report on the early winter foods of ruffed grouse on the George Washington National Forest, the Bureau made recommendations as to forest clearings and other improvements of grouse habitat.

Dove studies.—Investigations of the breeding and other habits of white-winged doves in Arizona contributed basic information for fixing hunting-season dates and adopting other management policies.

Big-game estimates.—Data on the Bureau's big-game inventory of the United States for 1937 were collated and the results issued as a leaflet (BS–122).

Food of coyotes.—An extensive study of the food habits of coyotes revealed that more than 75 percent of their feeding is on rodents and carrion and thus economically beneficial or harmless, and about 20 percent involves the destruction of domestic stock, poultry, deer, and wild birds.

WILDLIFE RESTORATION

State restoration projects.—Of 87 Federal-aid projects submitted by 37 States, 58 (in 31 States) were approved. The 87 projects were divided as follows: Game-management research, 30; development for wildlife, 28; acquisition of refuge areas, 28; and combination research and development, 1.

Acquisition of resettlement projects.—Eight former resettlement projects, involving about 300,000 acres, were transferred to the Biological Survey for use as wildlife refuges.

State cooperation.—Virginia and Maryland enacted legislation consenting to the segregation for national sanctuaries of water areas important to migratory birds.

Reservation of bighorn ranges.—The Kofa and Cabeza Prieta Game Ranges, Ariz., aggregating 1,520,000 acres, were established in cooperation with the Grazing Service, Department of the Interior, principally for the protection of the Gaillard bighorn sheep.

Refuge revenue.—From sales of surplus big game and other products of national wildlife refuges and from fees for uses of refuge lands, $45,213.52 was deposited in the Federal treasury.

LAW ENFORCEMENT

Illegal game handling.—Provision by Congress of funds for undercover operations greatly facilitated work for preventing illegal game dealing; constant vigilance was exercised to suppress nefarious attempts to revive the use of plumage of wild birds in the millinery trade.

Court decision on baiting.—A district court ruling makes it unnecessary for the Government to aver in the information or to prove at the trial that a defendant had knowledge of the unlawful baiting of a hunting ground to render him amenable to punishment for a violation of the Federal law protecting migratory birds.

International-boundary patrol.—Joint aerial-boundary patrol by wildlife agents of the Alaska Game Commission and Provincial police officers of Canada broke up a well-organized ring engaged in smuggling wolf and coyote pelts into Alaska for collecting the $20 Territorial bounty and also resulted in the apprehension and conviction of game-law violators on both sides of the border.

PEST CONTROL

Waterchestnut suppression.—Cooperative work was begun for determining and applying methods for the control of the introduced waterchestnut, a plant that impedes river navigation and lessens the value of infested areas to waterfowl and fishes.

Predatory animals.—Further protection of domestic livestock, poultry, and game resulted from the taking of 104,076 predatory animals in cooperative campaigns.

Injurious rodents.—Under Bureau supervision 35,465,078 rodent-infested acres were treated to protect crops, range vegetation, silvicultural plantings, and irrigation and soil-conservation structures.

DISSEMINATION OF WILDLIFE INFORMATION

Continuing its function of disseminating information on its activities in wildlife research, conservation, and management, the Bureau contributed several numbers to the Department's series of new and revised publications and issued a number of brief leaflets to assist in answering correspondence.

Through the facilities of the National Broadcasting Co., during the National Farm and Home Hour, a spokesman for the Bureau discussed various wildlife problems and activities in a weekly series of radio talks, and the Bureau cooperated with the American Wildlife Institute by furnishing speakers and information for many of the weekly programs broadcast on a network of the Mutual Broadcasting System. Many other radio talks and other addresses were made by members of both the Washington and field staffs. Statements were furnished the press on the important developments in the Bureau's work, and the increasing interest of the press and writers in wildlife information was served in correspondence and interviews. An increase in requests for photographs was noted. Plans were made for motion-picture work but had not progressed far enough to make possible an adequate program.

Members of the technical staff represented the Bureau at gatherings of scientists, conservationists, stockmen, farmers, and others interested in various phases of wildlife research and management, where they had opportunity to present in detail many matters summarized in this report.

FUNDS AVAILABLE

To finance the work of the Survey for the year a total of $6,889,344 was available from regular and emergency appropriations. Of this sum, $3,063,340 was carried in the Agricultural Appropriation Act for regular activities; $1,009,008 was deposited from sales of Federal migratory-waterfowl hunting stamps; and $22,810 was allocated from the Bankhead-Jones special research fund. From the Emergency Relief Appropriation Act of 1938 there was allocated $1,321,786 for water-conservation and wildlife-restoration work and $82,500 for administrative expenses; and $1,389,900 was made available for expenditure in connection with work performed by the C. C. C. on national wildlife refuges.

ORGANIZATION

No changes in the major organization were made during the year. The officials in charge of the several divisions on the date of this report, together with the regional directors, are listed below. All 10 regions are now in full operation.

Chief of Bureau—Ira N. Gabrielson
Associate Chief—W. C. Henderson
Chiefs of divisions:
- Administration—W. R. Dillon
- Public Relations—H. P. Sheldon
- Wildlife Research—W. B. Bell
- Federal Aid in Wildlife Restoration—A. M. Day
- Land Acquisition—Rudolph Dieffenbach
- Wildlife Refuges—J. C. Salyer, II
- Construction and C. C. C. Operations—H. W. Terhune
- Game Management—W. E. Crouch
- Predator and Rodent Control—Dorr D. Green

Regional directors (with headquarters):

1. Pacific—Thomas B. Murray (acting), Portland, Oreg.
2. Mountain—Leo L. Laythe, Denver, Colo.
3. Southwestern—John C. Gatlin, Albuquerque, N. Mex.
4. West Central—George Tonkin, Des Moines, Iowa
5. Southern—Roy Moore, New Orleans, La.
6. East Central—Daniel H. Janzen, Milwaukee, Wis.
7. Southeastern—James Silver, Atlanta, Ga.
8. Northeastern—S. Barry Locke, Boston, Mass.
9. Plains—Burnie Maurek, Omaha, Nebr.
10. Alaska—Frank Dufresne, Juneau, Alaska

Under a ruling of the Civil Service Commission all positions under the Alaska Game Commission were placed in the classified civil service and the employees were given competitive status, including retirement benefits.

A directory of field activities of the Biological Survey, organized geographically and containing also a brief functional and historical account of the Bureau and a statement of the functions of each of its divisions, was issued in June as Miscellaneous Publication 343.

RESEARCH ON THE STATUS AND MANAGEMENT OF WILDLIFE

MIGRATORY WATERFOWL

INVESTIGATIONS IN CANADA

Investigations into the status of migratory waterfowl were resumed during the summer of 1938 under the leadership of the Bureau's four flyway biologists. Vast areas in Canada and Newfoundland as well as in Alaska were surveyed from both ground and air. North to the Arctic coast in every section where the conditions were favorable the investigators found evidence of further increases in ducks and geese. Nevertheless, they were unanimous in concluding that available habitat can still support greatly increased waterfowl populations.

In the Pacific flyway the investigator pressed his work northward through British Columbia, checking areas that had received attention in previous seasons. Conditions continued to be satisfactory in this Province, but little change was detected.

Because of the convergence in Canada of the Central and Mississippi flyways, they are here treated together. Although the average precipitation in Alberta and Saskatchewan was still far below normal, nesting conditions were somewhat more favorable.

In Alberta, thousands of sloughs in the district east of Calgary continued dry, but some were sufficiently filled to be satisfactory for nesting. Some water areas had a fair duck population, but the average was low, especially in numbers of birds actually raised. Beyond this zone, to about latitude 52°, most of the prairie lakes and sloughs remained dry or were so lacking in cover as to be unattractive to ducks. Farther north, however, conditions were somewhat better and indicated an increase of possibly 20 percent in the total duck population.

Drought in many localities of Saskatchewan has been continuous for so many years that relatively little general improvement could be expected. The pot-hole sectors in the southern part remained dry or otherwise unattractive to ducks. Of the 15 Provincial bird sanctuaries that were dry in 1937, 6 remained so in 1938, as did also 9

of the 13 public shooting grounds. Of the lakes that 10 or more years ago provided excellent waterfowl nesting conditions, scores were still dry. Reports from sections about Prince Albert indicated that pot holes were even drier than in 1937 and that fewer ducks nested there. Nevertheless, field studies indicated a slight improvement.

Fires in certain large marshes, particularly in Manitoba, continued to be serious problems, as they destroy valuable food and cover and also nests and the birds themselves. On one section of 10,400 acres south of the town of Delta, which had been swept by a fire that spread over an area estimated to be fully 10 times as large, 1,300 destroyed duck nests were counted, averaging 8 eggs each. In the southern part of this Province, however, particularly in the marshes at the south end of Lake Manitoba, a marked improvement in waterfowl conditions was noted, with a decided increase in the number of redheads and canvasbacks and some increase also in shovelers. The biologists felt, however, that in the Prairie Provinces in general there was cause for optimism regarding the duck situation. They found that broods averaged larger and estimated that nesting birds showed an increase of about 10 percent over 1937.

The 2,500 square miles of duck-nesting habitat in the great marshes of the Athabaska delta also showed improved production. The biologist of the Mississippi flyway made his fourth consecutive annual trip to this important nesting ground and reported that, despite low water levels, the waterfowl were considerably more abundant than last year or any year since 1935.

Proceeding by plane, the biologist resumed investigations in another important waterfowl area of the North—the lower Mackenzie delta. The study there indicated that while ducks were somewhat less numerous than in 1937, their numbers were satisfactory. Any possible reduction in the duck supply was compensated for by an excellent increase in the number of swans, geese, and black brants.

About the middle of July the biologist flew from Aklavik, in the Mackenzie delta, via Fort Norman, on Great Bear Lake, to Coppermine, on Coronation Gulf, and thence reached the easternmost point of his journey in the Arctic at Cambridge Bay, on the southeastern coast of Queen Victoria Island. From this point on the night of July 18 he attempted to fly to Perry River in the Flagstaff Island group, about which practically no information is available. He was successful in locating the river but could not land because of ice conditions. From his aerial survey, however, he reported that as a waterfowl habitat the Perry River country had all the appearance of a second Mackenzie delta. Between it and the Ellice River, a distance of about 70 miles, the many streams emptying into the Queen Maude Sea and the numerous lakes probably make this section a waterfowl nursery second to few in the Arctic. The place is so nearly inaccessible that few white men have ever visited it, and the Survey biologist and his pilot are probably the first to have seen it from the air.

The biologist for the Atlantic flyway, entering Canada on May 11, made extensive investigations through the first half of July in New Brunswick and Nova Scotia, and in Quebec along the north shore of the Gulf of St. Lawrence. He stated that from the excellent conditions observed and reported by others in New Brunswick there

would be a good increase of wild fowl during the season, particularly over the 1937 numbers of Canada geese and black ducks. In Nova Scotia, investigations in the vicinity of Wolfville and in every important waterfowl area also indicated a slight increase over the 1937 numbers of black ducks. The coast of Canadian Labrador, in southern Quebec, was covered for a distance of nearly 600 miles from Bradore Bay west to Mingan, where the Canadian Government has several migratory-bird sanctuaries, all of which were visited. Later in the season Quebec was again entered by way of St. Simeon, and observations were made north into the interior to Lake St. John, Mont Laurier, and Rouyn. At this period reconnaissance was made also in Ontario north as far as Cochrane and west to Sault Ste. Marie.

The Atlantic flyway biologist spent the period July 19 to August 3 in Newfoundland, most of the southern coast of which he was enabled to cover through the cooperation of the Department of Natural Resources. All the information obtained pointed to a successful season, with increased waterfowl production over that of 1937.

INVESTIGATIONS IN ALASKA

On completion of the survey in British Columbia, the biologist of the Pacific flyway proceeded to Alaska, where with the active cooperation of the Alaska Game Commission he made a reconnaissance of the chief waterfowl-breeding grounds. Beginning at Fort Yukon, on the Porcupine and Black Rivers, he made the long trip down the Yukon and in its vast delta explored many of the channels and adjoining tundra areas. After a flight across the height of land and similar investigations of the intricate maze of channels and muskegs of the Kuskokwim River, he wrote: "It is beyond the scope of imagination for the average resident of the South to visualize even remotely the extent of the northern nesting grounds." Natural food plants were abundant, and it seemed probable that Alaska produces a much larger percentage of the continental supply of wild fowl than has formerly been believed. Reports of Alaskans indicated a steady improvement in the supply of ducks, but not a comparable increase of geese. There was abundant evidence, however that the available waterfowl habitat in Alaska is woefully underpopulated.

INVESTIGATIONS IN MEXICO

In western Mexico, the biologist of the Pacific flyway continued investigations from the latter part of November to the first of March. Work was done in 15 States, 1 Territory, and the Federal District, with the full cooperation and assistance of Mexican officials, particularly those of the Department of Forests, Game, and Fish, and of American consular and diplomatic officers.

Further evidence was obtained of the importance of the Mexican wintering grounds to the waterfowl of the Pacific flyway. One of the most important waterfowl concentration points was found in the great irrigation projects in the valleys of the Yaqui and Mayo Rivers, Sonora. Here probably 300,000 acres are under canal systems

for growing wheat, rice, and garbanzo (chickpea), and the fields are a very important source of food for wild fowl.

Sinaloa has a like situation in the valleys of the Fuerte, Sinaloa, and Culiacan Rivers, and from the seaport town of Mazatlan to the valley of the Rio Grande de Santiago, Nayarit, a distance of fully 100 air miles across parts of both States, there is a continuous chain of coastal estuaries, sluggish rivers, lakes, marshes, and swamps.

Conditions are similar in Nayarit, and, because of the famed Lake Chapala, in Jalisco and Michoacan also. Here the delta of the Lerma and Duero Rivers has been partly drained, but the area still remains one of the greatest concentration places for ducks, as also do Patzcuaro, Cuitzeo, and other important lakes of Michoacan. In all the smaller States visited, the Survey biologist found abundant waterfowl habitat, and on the Laguna de Coyuca and Laguna de Tres Palos, in Guerrero, a veritable paradise for wintering lesser scaups, pintails, baldpates, and other ducks.

In concluding his report, which treats of each State and species, the Bureau investigator asserted that the duck and goose population of western Mexico showed marked improvement in numbers over that of preceding years.

On the east (Gulf) coast, the Central flyway biologist divided his time between the wintering grounds of the Laguna Madre section of southern Texas and the coastal parts of eastern Mexico, making an aerial reconnaissance from the Rio Grande to the northeastern tip of the Yucatan Peninsula and carrying on ground work by car along the coast of Tamaulipas and northeastern Vera Cruz.

The marsh and water areas in eastern Mexico bear almost the same relation to the birds of the Central flyway as do those of western Mexico to the waterfowl of the Pacific flyway. The more important of these wintering grounds are the coastal lagoons of Tamaulipas, the Tamiahua Lagoon and Alvarado district of Vera Cruz, the coastal lagoons and marshes in northeastern Tabasco, and the narrow coastal lagoons and marshes of Yucatan.

An aerial survey of the coastal districts in 1937 gave a basis for comparison with data obtained in 1938. Flights were extremely low, so that great accuracy was possible not only in identifications but also in estimations of numbers. The investigator reported satisfactory evidence of a definite increase in some species. Although he received local reports of greater increases, he believed that the general increase was possibly 10 percent over the winter population of 1937–38 and that there were at least 5,000,000 ducks in the eastern coastal lagoons and marshes.

Information obtained by these biologists indicates that the total take of waterfowl by Mexicans is so low as to be almost negligible. The extent of legal market hunting there has been and still is grossly exaggerated. At a few places along the routes followed by tourists, ducks are sold in markets and served in restaurants. Those familiar with cities immediately south of the international border naturally infer that the serving of game dinners is general, whereas it is done chiefly near the border to attract tourists. There are very few cities in Mexico where game is marketed to any considerable extent. Vigorous efforts are being made by the Mexican game authorities to enforce the game law prohibiting the use of "armadas" (batteries of

shotgun barrels fastened together and fired simultaneously), and troops of the regular army have even been employed for this purpose.

INVESTIGATIONS IN THE UNITED STATES

Spring and fall migrations were again observed by the Bureau's corps of carefully selected agents and volunteer cooperators in the United States. Analysis of the figures obtained confirmed the reports made by the field biologists that the numerical status of most species was continuing to improve. The increases reported for the redheads and canvasbacks were particularly gratifying, fully vindicating the regulatory action taken for their protection.

On the national wildlife refuges and most other areas, the results of the breeding season of 1938 were a great success and reports of increases were unanimous. Improvement factors consisted not only of curtailment of the kill in recent years but also of greater stabilization of water levels, better nesting habitats resulting from planting programs and restrictions on grazing, selective control of natural enemies, and more adequate protection of breeding stock along migration routes and on wintering grounds.

The biologists of the Mississippi and Atlantic flyways devoted the winter to constant checking and rechecking concentrations at the southern ends of these two great areas, which, unlike those of the Pacific and Central flyways, are chiefly in the United States. For this reason Federal refuges in the lower Mississippi Valley and on the South Atlantic and Gulf coasts are of great importance. In the wintering grounds of the Atlantic flyway, waterfowl conditions remained satisfactory and an increase in most species was obvious.

The general improvement affected practically all species of ducks. Although the blue goose is abundant in winter on the Louisiana coast, there was an apparent shortage of immature birds. The situation for this species had been noted earlier in the season by Canadian officials on the basis of reports from the James Bay region and appears to indicate an unsuccessful breeding season.

The fifth annual inventory of migratory waterfowl was made in January, under the leadership of the 10 regional directors. Full cooperation was extended by the Army Air Corps, the Naval Air Service, Coast Guard, Forest Service, Soil Conservation Service, National Park Service, State forestry, game, and fish departments, a commercial rubber company, and many other agencies and individuals, and in addition practically the entire field force of the Survey was drafted.

The aerial coverage included the entire Atlantic and Gulf coasts. In region 7 (Southeastern), 11 planes and 3 blimps were used in addition to 18 powerboats and 28 cars, with a total of 240 observers. In region 8 (Northeastern) in addition to planes of the Coast Guard, 2 blimps from the Naval Air Station at Lakehurst, N. J., were employed. In a few areas severe storms complicated the operations and undoubtedly resulted in the tabulation of smaller numbers of birds than would have been observed a short time previously. In most cases, however, familiarity with the situation enabled the agents to make proper allowances, and sudden decreases in one area were usually compensated for by corresponding increases in others. Experience in the work has contributed greatly to the accuracy of the results, so that while cover-

age of the entire country is still incomplete, it is felt that the data assembled are dependable for comparative purposes.

The grand total in waterfowl for all regions for the 1939 inventory was about 14,500,000, which represents an increase of about 14 percent over 1938. The ratios between figures for all species are not the same—for a few a decrease was noted. Important gains were noted in some of the principal game species—the redhead, mallard, black duck, pintail, baldpate, and the scaups. Particularly encouraging is the substantial gain in the numerical status of the redhead. The increase for the scaups is somewhat surprising in view of reports obtained earlier in the season. Geese showed an aggregate decrease, a small increase in the Canada goose being offset by a decrease in the blue goose, probably because of a poor breeding season. The coot, or mud hen, showed a disproportionate increase, and there is evidence that this bird is too abundant for the welfare of other waterfowl more desirable to man.

Results of investigations of the waterfowl situation in the United States for 1938–39 were reported in a leaflet (BS–136) issued in May.

BANDING GAME AND OTHER BIRDS

WORK ON FEDERAL REFUGES

Inasmuch as the use of bait and live decoys in hunting ducks and geese has been outlawed during recent years by Federal regulations, waterfowl were banded chiefly by the regular personnel on Federal and State refuges. Stations in operation on 48 Federal refuges and on 15 State refuges, game farms, and sanctuaries reported the banding of 36,826 birds, almost entirely migratory waterfowl. The figures for Federal refuge stations where the total bandings for the year totaled 1,000 or more are as follows:

Refuge	*Number*	*Refuge*	*Number*
Sand Lake, S. Dak	7,705	Tule Lake and Clear Lake, Calif.; Klamath Lake, Oreg	1,606
Malheur, Oreg	7,022	Lacreek, S. Dak	1,342
Des Lacs, N. Dak	4,988	Medicine Lake, Mont	1,211
Sacramento, Calif	2,368	Bear River, Utah	1,136
Piedmont, Ga	2,117	Waubay, S. Dak	1,024
Lake Mattamuskeet, N. C	2,007	White River, Ark	1,003

Stations are planned for other refuges favorably situated on the different flyways, and those already established will expand their work.

BIRDBANDING COOPERATORS

Physical limitations in the handling of the great mass of birdbanding records continue to make it necessary to decline many offers of cooperation. There were on the list at the end of the year, however, 2,290 cooperators as compared with 2,193 a year ago. Four of the volunteer station operators each reported the banding of more than 10,000 birds, as follows: E. A. McIlhenny, Avery Island, La., 28,845; O. L. Austin, North Eastham, Cape Cod, Mass., 19,846; John B. Calhoun, Nashville, Tenn., 16,532; and George H. Lowery, Jr., Baton Rouge, La., 11,499.

NEW BIRDS BANDED

The number of new birds reported banded was 436,648, an increase of 90,592 over 1938. This brings the grand total banded since this work was taken over by the Survey in 1920 to 3,284,142. For each of the following species 10,000 or more individuals were banded: Chimney swift, 71,623; junco, 22,274; purple finch, 21,595; white-throated sparrow, 20,495; pintail, 19,160; common tern, 17,179; herring gull, 17,168; mallard, 16,732; and black duck, 10,207. Bandings exceeded 1,000 for each of 55 other species, 8 of which were migratory game birds, as follows: Baldpate, 1,449; green-winged teal, 1,721; blue-winged teal, 4,118; lesser scaup duck, 5,290; ring-necked duck, 1,953; Canada goose, 1,187; coot, 2,401; and mourning dove, 5,539.

The following nine species were new to the list of banded birds: Bridled tern, love tern, allied shearwater, Christmas Island shearwater, and red-tailed tropicbird (all from Hawaii), and the yellow-billed tropicbird, glossy ibis, ivory-billed woodpecker, and black rosy finch.

The numbers of the different species of waterfowl banded during the fiscal years 1938 and 1939 are shown in table 1.

TABLE 1.—*Waterfowl banded during the fiscal years 1938 and 1939*

Species	1938	1939	Species	1938	1939
	Number	*Number*		*Number*	*Number*
American merganser	6	32	Canvasback:		
Red-breasted merganser	15	1	Wild	644	410
Hooded merganser	9	14	Hand-reared	96	77
Mallard:			Greater scaup	165	914
Wild	11,519	15,751	Lesser scaup	5,295	5,290
Hand-reared	2,068	981	Ring-necked duck	2,057	1,953
Black, cross	8	20	American goldeneye	3	10
Black duck:			Barrow's goldeneye		1
Wild	6,319	8,653	Bufflehead	29	18
Hand-reared	1,029	1,554	Old squaw	7	
Florida duck	159	86	American eider	4	4
Gadwall:			American scoter	2	
Wild	694	773	White-winged scoter	4	23
Hand-reared		8	Surf scoter	1	
European wigeon	5		Ruddy duck	83	41
Baldpate	1,379	1,449	Snow goose	34	4
Green-winged teal	8,372	1,721	Blue goose	280	16
Blue-winged teal	5,353	4,118	Ross' goose	3	
Cinnamon teal	420	379	White-fronted goose	39	8
Shoveler	495	582	Canada goose:		
Pintail:			Wild	458	1,163
Wild	16,060	18,861	Hand-reared	15	24
Hand-reared	300	299	Black brant	9	
Wood duck:			Emperor goose		1
Wild	405	414	Fulvous tree duck	15	1
Hand-reared	188		Whistling swan	5	7
Redhead:					
Wild	2,083	574	Total	66,234	66,290
Hand-reared	100	55			

RETURN AND RECOVERY RECORDS

The number of banded birds recaptured during the fiscal year, either at the station of banding or elsewhere, was 26,998, an increase of 4,048 over the preceding year. This brings the number of recovery records to 202,913, which is the largest collection in existence of precise information relative to the movements of individual birds.

During the open shooting season for migratory birds letters reporting returns averaged about 100 a day, with a peak total of nearly 250. Through the assistance of the Works Progress Administration several thousand records that had accumulated in past years were coded, carded, and verified. Outstanding return records were published in the quarterly journal Bird-Banding, and the annual number of Bird Banding Notes was issued in September.

Several thousand herring gulls at key breeding colonies on the Atlantic coast were marked with different colored celluloid bands in addition to the numbered aluminum bands. The large numbers of "sight recoveries" reported therefrom are being analyzed in cooperation with the Linnaean Society of New York.

RECORDS OF DISTRIBUTION AND MIGRATION

Data added to the files on the distribution and migration of North American birds continue to increase the value of this repository. The acquisitions included 50,000 distribution and migration records, 1,500 locality cards, and 900 bibliographic entries.

General migration observers now reporting total 375, and many of them have long periods of service. A digest of their spring (1938) migration data was issued as Bird Migration Memorandum No. 4, on June 15.

At the request of a private publisher a manuscript was prepared for a book, which appeared in June, under the title "The Migration of American Birds." It is an expansion of the Bureau's Circular 363, The Migration of North American Birds, and is illustrated by 22 maps and 12 color plates. In a volume entitled "Life Histories of North American Woodpeckers," issued as Bulletin 174 of the United States National Museum, data on the distribution and migration for each species were prepared by the Biological Survey; similar data were supplied on parrots, cuckoos, trogons, kingfishers, goatsuckers, hummingbirds, and swifts, the life histories of which will be published by the Museum during the coming year.

In the work of drafting distribution maps of North American birds, valuable aid was rendered by the W. P. A. in bringing to date 107 maps, covering the shorebirds, ducks, and geese, and in making new maps for 83 species, including the families of swifts, hummingbirds, flycatchers, crows, jays, and some of the sparrows and finches.

WILDLIFE RELATIONSHIPS TO FOREST AND RANGE

Two manuscripts on the relationships of wildlife to forest trees were completed, based on research at the Northeastern Forest Experiment Station, Conn. A study of the effects of the 1938 hurricane in New Hampshire indicated that the long-time results will probably be more beneficial than detrimental to wildlife. A game-food-shrub interplanting study on coniferous plantations was initiated at the Chenango Experimental Forest, N. Y., where 5,000 red-osier dogwoods were set out in experimental clump patterns to determine the best spacing. Survival and rodent-damage tallies will be kept.

Investigations of the overpopulations of white-tailed deer in Minnesota were continued at the Lake States Forest Experiment Station,

Minn., with special emphasis on the effect of overbrowsing on choice deer foods; some of the results were set forth in a leaflet (BS–137) entitled "Fall and Winter Food Habits of Deer in Northeastern Minnesota." Investigations of aspen utilization by beavers were continued, and trapping and marking studies were conducted to correlate food usage with animal abundance.

At the Southern Forest Experiment Station, La., the effect of birds and rodents on longleaf pine reproduction received primary attention. Birds consume a great deal of the annual seed fall, but the damage can be controlled. A mimeographed leaflet entitled "The Relation of Birds to the Establishment of Longleaf Pine Seedlings in Southern Mississippi" was issued as Occasional Paper 75 of the experiment station. Experimental plots were established on the Harrison Experimental Forest, Miss., at intervals of about 1 month late in fall and early in winter, to determine what effects ground cover and sowing seed at different seasons have on bird depredation and on the survival and germination of seed.

A 7-year study of pocket gopher relationship to mountain-meadow range at the Pacific Northwest Forest Experiment Station, Oreg., indicates that normal populations of these rodents and moderate grazing by livestock allow these ranges to remain stable; overgrazing causes competitive demands upon forage, making rodent activities more apparent; nongrazing permits accumulation of surface litter favorable for heavy populations of meadow mice, which deplete range plants through crown injury. As many as 35 white-footed mice to the acre have been found during the period that ungerminated Douglas fir seed remains on the ground. Shrews, previously considered noninjurious to the seeds, were found to be important in their destruction. Cropping of young conifers in this region was done mainly by rabbits. Studies show that mountain beavers are of minor importance in coniferous forests. A report on wildlife in relation to reforestation in the Douglas fir region of Oregon and Washington was completed.

Studies of wildlife in relation to western range were continued at San Joaquin Experimental Range, Calif., in cooperation with the Forest Service and the University of California. They included the effect of rodents on the composition of the plant community and the annual yield of forage, the life history and food habits of each species of rodent, population fluctuations, means of marking various species of small mammals for individual identification, and predation. A deer-management study developed from a study of the coyote-deer relationships on the Los Padres National Forest. Some 7,000 coyote droppings analyzed showed more than 160 different food items, with deer the most important, fruit second, and rodents well down the list; and the contents of 200 coyote stomachs examined revealed similar food data. That coyotes are levying heavy toll on fawns and first-year deer in these southern California brush areas is indicated not only by the hair, bones, and fawn hoofs found in the droppings, but also by the greater survival of fawns on trapped areas. During the year two leaflets were issued entitled "Factors in Nesting Losses of the California Valley Quail" (BS–124) and "Some California Wildlife-Forest Relationships" (BS–132).

BIOLOGICAL RESEARCH ON WILDLIFE REFUGES

Aerial photographs of the Wichita Mountains Refuge, Okla., were obtained from the Army Air Corps for use as a base map for plotting vegetative types. A survey of forage conditions to determine improvement resulting from the first year of elimination of permitted livestock disclosed an increase in the volume of forage but not of the more palatable plants. The wild turkey study was continued, and a census covering 5 months showed 487 on the refuge in February.

Progress was made in the development of the Patuxent Research Refuge, Md., as an investigative center. The main laboratory built last year was equipped and is occupied by several workers. Construction completed included a wildlife-disease laboratory, greenhouse, apartment house, two residences for officials, and garages and other buildings. The old mansion, Snowden Hall, was reconditioned for use as refuge headquarters, 16 acres were graded and landscaped, and the 60-acre artificial Cash Lake was filled with water. The refuge, which is adjacent to the Agricultural Research Center, at Beltsville, was officially dedicated by Secretary Wallace on June 3.

Extensive study was devoted toward improving the Bull Island unit of the Cape Romain Refuge, S. C., particularly as a sanctuary for the eastern wild turkey, now rapidly nearing extirpation. A detailed study of this bird is being made throughout the Southeastern States, especially in the Santee, Great Pee Dee, and Savannah River sections of South Carolina and Georgia, with a view to its preservation and restoration.

WILDLIFE-MANAGEMENT RESEARCH

COOPERATIVE RESEARCH UNITS

On the 10 wildlife-research units, which function in cooperation with land-grant colleges, State game commissions, and the American Wildlife Institute, the programs included basic research into wildlife-management problems, training of advanced students and research workers, testing proposed methods in trial areas, and recommending and demonstrating improved management practices. Extension is being carried on at most of the units. A total of 190 workers were engaged for whole or part time, as follows: Alabama, 18; Iowa, 26; Maine, 17; Missouri, 22; Ohio, 29; Oregon, 17; Pennsylvania, 12; Texas, 16; Utah, 14; Virginia, 19. A leaflet (BS–129), Cooperative Wildlife-management Research, was issued in March.

Alabama.—The research unit at the Alabama Polytechnic Institute conducted six projects on the life history and management of important game species. Data were obtained on breeding, nesting, growth rate, plumage change, food habits, and migration of the mourning dove. Some of the findings were presented in a leaflet (BS–133), entitled "A Preliminary Investigation of the Food Habits of the Mourning Dove in Alabama." In the bobwhite studies, operations centered on the adaptation of quail-management practices to farming conditions in the major soil provinces, including the establishment of an 1,800-acre trial-demonstration area on privately owned land. A mimeographed leaflet, Planting Food Crops for Game Birds, was issued by the Agricultural Experiment Station of the Alabama

Polytechnic Institute, and a bulletin, Winter Foods of Bobwhite Quail in the Black Belt Soil Provinces of Alabama, was published by the Alabama Department of Conservation. Other studies were concerned with white-tailed deer, wild turkeys, and the food of foxes and waterfowl at the Gulf Shores State Park.

Iowa.—Two experimental areas were established in southern Iowa by the Iowa research unit, at the State college, to test methods of quail management. On one, the farmers were encouraged to adopt game management and the sale of hunting rights as a means of increasing their income; on the other, they were paid 10 cents an acre for practicing game management and encouraged to permit free shooting. At the end of 2 years a survey indicated that the bulk of the management, which was about the same on both areas, had been done by farmers who were themselves sportsmen, irrespective of fees. An area was set aside in Winnebago County for investigation of the ring-necked pheasant, especially its winter survival. It was learned that near their source of food the birds need cover so tall that it will not drift full of snow. During periods of high wind and severe cold it proved advisable to make food available within the cover itself. Other studies were on the ecology of the muskrat, distribution and ecology of plants in waterfowl breeding areas, analysis of range carrying capacity for the bobwhite in winter, life history and management of striped and spotted skunks, ecology of mourning doves, ecology and management of the raccoon, American coot, red fox, and western fox squirrel, and parasites and diseases of the rabbit, quail, pheasant, and wild ducks.

Maine.—Woodcock-management studies continued to be one of the chief lines of research at the Maine research unit at the State university. Questionnaires sent to hunters and wardens showed that the status of the woodcock had improved slightly, and a singing-ground count of breeding pairs showed a 2-percent increase over the previous year. A cedar-reproduction plot was established with 100 trees, 50 of which were topped and 50 left natural to determine whether topping tends to increase the length of limbs, thus making more browse available for deer. Research on fish-eating birds continued. No evidence was obtained connecting the tapeworm of gulls with that found in bass. Other investigations involved waterfowl surveys of Penobscot County and the Lincoln area, life history and management of the raccoon, life history and diseases of the moose, deer weights and measurements, and snowshoe hare reproduction.

Missouri.—Investigations on the life history, ecology, and management of the wild turkey in Missouri in cooperation with the Forest Service still rank as an important project at the Missouri research unit at the State university. Although turkeys have not greatly increased during the past 3 years, predation seems to be of little consequence to the adult birds. Limiting factors operate during the nesting and brooding periods, as during the current season not more than 50 percent of the hens hatched a clutch of eggs. A study of the chukar partridge disclosed that of 104 birds found dead in the wild, 87 percent died within 2 months after release and that in the summer of 1938, 46 nesting pairs produced an average of 9.3 young each. Other investigations by the Missouri unit included a preliminary study

of the southern woodchuck, a survey of the distribution and economic importance of Missouri hawks, management of field borders in relation to agriculture and wildlife production, ecology and management of the white-tailed deer, bounty statistics on wolves, coyotes, and bobcats, ecology and management of the bobwhite and prairie chicken, wildlife-cover mapping, and ecology of song-bird communities.

Ohio.—At the Ohio research unit, at Ohio State University, special attention was devoted to pheasant management, a complete analysis having been made of the strength or weakness of each factor and the cause of success or failure of each in controlled hunting, especially in northwestern Ohio and Wood County. A census and tabulation of the hunting experiences each year of 1,000 local, city, and farmer hunters is maintained. Analysis is being made of all agricultural and land-use factors affecting pheasant production. An investigation of the life history and management of the fox squirrel was continued, with special attention to the development of research and management techniques. Work was also done on the gray squirrel, and a leaflet (BS–134) entitled "A Summary of the Gray Squirrel Investigation of Southeastern Ohio," was issued. Research on the raccoon included studies in the wild on ecology, habitats, and populations, and in captivity on diseases, nutrition, and life history. Other studies were made on foods, populations, and diseases of cottontail rabbits; population trends, cycles, and land-use factors affecting Hungarian partridges; and the status of waterfowl at Pymatuning Lake and in Lake Erie marshes. Preparation of a manual of Ohio wildlife resources was advanced.

Oregon.—Studies of small game in the Willamette Valley by the research unit at the Oregon State College resulted in action by the State Game Commission stressing quality birds on game farms, reliance on natural reproduction to carry the shooting load, liberation of birds on a scientific basis, and adjustment of open seasons and bag limits. A study of the life history and management of antelopes resulted in a controlled hunting season on a cropping-plan basis. It showed the need for limitations, as the kill was 72 percent efficient over three shooting areas and 85 percent on one. Among other problems investigated were wildlife and range management, management of the sage-hen, and game management on farm lands in the Willamette Valley.

Pennsylvania.—The recently established research unit at Pennsylvania State College has outlined an extensive program. In one of the major long-time projects, an economic and ecological survey of Pennsylvania wildlife, work was carried forward on upland birds, especially the pheasant, bobwhite, ruffed grouse, and woodcock. A census technique for white-tailed deer in Pennsylvania is being developed. The chief accomplishment of the project on the ecology, life history, and management of the black bear was the collection of specimens illustrating food habits. Ecological relationships between cottontails and woodchucks were covered in part by studies of the nesting of cottontails, population densities of cottontails and woodchucks, use of woodchuck dens by cottontails, and the distribution of woodchucks. Other projects are concerned with the nutritive value of winter deer browse and mast, silvicultural practices affecting deer foods, propagation and nutrition of game birds, and wood-lot management.

Texas.—A comprehensive study of Attwater's prairie chicken was completed by the Texas research unit at the agricultural and mechanical college. Noteworthy also are county surveys carried forward in 4 counties—Colorado (east Texas timber type and gulf prairie), Harris (gulf prairie), La Salle (Rio Grande plain, "brush country"), and Culberson (Trans-Pecos mountain and valley)—of the geology, soils, vegetation, and vertebrate animal life, to serve as the basis for wildlife-management plans in the regions of which these counties are typical. Improvements are being made in the establishment of headquarter areas for bobwhite quail. From 1936 through 1938 several hundred such areas were established in overgrazed parts of 6 counties, and a recent check of 81 of them showed bobwhite quail on 70 percent, many of them in areas not previously occupied by coveys in winter. Work was also done on the armadillo, white-necked raven, Texas bighorn sheep, Texas beaver, and several other near-vanishing species. A recently completed study of the relationship of the stage of cut-over timberlands to bobwhite production forms a basis for effective management on the 12,000,000 acres of this type in the eastern part of the State.

Utah.—The mule deer, most important big-game species of Utah, continued to be the subject of a detailed life-history and management study by the Utah research unit at the Utah State Agricultural College. On the Cache National Forest, 220 adult deer were trapped, tagged, and released. Emphasis was placed on determination of winter conditions, migrations, winter losses, and methods and economics of supplemental winter feeding. With a view to preventing a recurrence of severe losses, detailed investigations were made of winter mortality on the Cache study area, where 539 deer were found dead. Observations have been made for 3 years on the sharp-tailed grouse, particularly on its life history and on factors influencing its distribution and abundance. Distribution in the intermountain region is correlated with the presence of unmodified remnants of original grassland. In a study of sage grouse, 142 nests in 1938 and 122 in 1939 were located and kept under observation, and in a predation study the coyote proved the most important enemy. On the beaver project a field party made a detailed survey of 144 miles of streams in and near the Wasatch National Forest, in which 77 stations were established for chemical study of water on various drainages and an inventory was made of organisms inhabiting streams and ponds. All streams surveyed contained trout, and no physical or chemical conditions adverse to their welfare were found. A State survey was also made of waterfowl marshes to determine available food and nesting cover.

Virginia.—At the research unit at the Virginia Polytechnic Institute, the wild turkey still maintains a leading interest. The captive hens stopped laying in 1938 by the middle of July, having produced approximately 27 eggs each, a total of 1,600. Only 64 percent were fertile, and only 34 percent of these hatched. In spite of a heavy loss of brood stock in 1939, more than 80 percent of the fertile eggs hatched, and a total of 740 poults were alive on June 30. Distribution and factors influencing abundance of wild turkeys in Virginia are being investigated through a cooperative arrangement with the University of Michigan, and it has been learned that the species is present in 74 of Virginia's 100 counties, that the highest population

occurs in the central or piedmont section, that there were over 22,000 wild turkeys in the State prior to the hunting season beginning November 15, that at the beginning of that hunting season the Statewide average was about 11 turkeys to the flock, and that from the rather meager 1938 data the legal kill may often exceed 50 percent of the turkey population in some sections. Deer-management studies have continued, and 211 animals were obtained for release, 18 of which were tagged and liberated on the Mountain Lake demonstration area. A paper was completed on a preliminary list of the mammals of Virginia, with a view to publication by one of the cooperating agencies. Studies were continued on farm game, more especially on the bobwhite, and progress was made on a vegetational survey.

BIOLOGICAL SURVEYS AND FAUNAL RESEARCH

Reports are in preparation on the mammals of Arizona and of Florida; the manuscript on a taxonomic revision of the red squirrels will be completed during the coming year if sufficient specimens from certain critical localities can be obtained; work on a taxonomic revision of the raccoons is nearing completion; and an extensive research on the history, habits, ecology, classification, and distribution of the North American wolves is progressing. An 834-page illustrated book on the Bird Life of Louisiana was published by the Louisiana Department of Conservation, in cooperation with the Biological Survey, and progress was made on the manuscript on the birds of Texas. Related publications issued include an article in the 1938 Yearbook of Agriculture entitled "The Problem: Drained Areas and Wildlife Habitats," and Circular 520, "Wildlife of the Atlantic Coast Salt Marshes."

Additions to the research collections of mammals, birds, and other vertebrates, which continue to serve as a basis for the work of the Bureau, included 1,183 specimens of mammals and 1,334 of birds. Identifications of 678 mammal specimens were made for 25 institutions and individuals in 17 States and 1 foreign country, 195 specimens were borrowed for study from 5 institutions and individuals in 4 States and 1 foreign country, and 369 specimens were lent to 13 cooperators in 11 States and 2 foreign countries. Bird specimens numbering 4,277 were identified for 50 institutions and individuals in 25 States and 2 foreign countries, and 492 were lent to 14 institutions and individuals.

Scientists of the Bureau described 41 new mammals in the genera *Hodomys*, *Microtus*, *Perognathus*, *Urocyon*, *Thomomys*, *Platygeomys*, *Pappogeomys*, and *Heterogeomys*. The total number of type specimens of mammals in the collection is now 1,292. The Bureau's mammal laboratory was used by 110 outside research workers from 22 States and 4 foreign countries. Continuation of the W. P. A. projects expedited the work of cleaning, repairing, and rearranging the mammal collection and cataloging and assembling data on birds.

A survey of big-game mammals in 1937 was completed through cooperation of Federal and State agencies, and the collated results were issued in January in a leaflet (BS–122). Work was in progress for a similar inventory for the year 1938.

ECONOMIC RESEARCH ON WILDLIFE

In the task of rehabilitating the wildlife resources of the country, research plays the fundamental role of providing scientifically tested methods of procedure. Investigations of the food and habitat requirements and of the economic status of wildlife and studies of methods of maintaining and developing desirable food and cover conditions for the various species are essential to intelligent game management, practical development of refuges, and efficient land utilization. Food-habit studies have made important contributions in furthering the restoration of waterfowl, fostering an abundance of upland game and other desirable species of wildlife, and suppressing forms that are injurious to man's interests.

WATERFOWL-MANAGEMENT INVESTIGATIONS

PROPAGATION OF FOOD AND COVER PLANTS

A comprehensive and well-illustrated Technical Bulletin (No. 634), entitled "Food and Game Ducks in the United States and Canada," was published to assist refuge managers, State conservation agencies, and others seeking to improve waterfowl habitats. In it the fact is stressed that much of the failure and wasteful expenditure that characterized former efforts to improve the food resources of game ducks is avoidable, and that applying information developed by research will reduce errors, expense, and disappointment. Plans for improving waterfowl-food resources will be aided by a knowledge of the three types of information contained in the bulletin: (1) Relative values to waterfowl of the various marsh and aquatic food plants in different regions; (2) the habitats, ranges, and identification of the more important species utilized as food; and (3) principles of plant propagation and marsh management. Recommendations on plantings for waterfowl areas having deficient supplies of natural foods were presented in a leaflet (BS–125) entitled "Natural Plantings for Attracting Waterfowl to Marsh and Other Water Areas."

ECOLOGICAL STUDIES OF FOOD AND COVER PLANTS

In cooperation with the Fish and Game Commission of Utah, a survey was begun to determine the chemical, physical, and biological conditions of waterfowl areas in the State and the possibilities of the development of these areas. Studies of the physical and chemical conditions of soil and water that influence the growth of aquatic duck foods on the Bear River Refuge indicate that the controlling factors are mainly physical (depth, muck deposition, and turbidity). Saline clay soils are not so productive of aquatics, regardless of the depth or turbidity of the water, as saline soils covered with a deposition of organic muck. Both laboratory experiments and field analyses indicated that this is due to the action of muck as an inhibitor to the infiltration of salt from the subsoil. During the growing seasons of aquatics the turbidity is so great on most of the refuge that light, which is essential to photosynthesis, seldom penetrates beyond 30 inches. Consequently, the best growth is in 1 to 2 feet of water, and

deeper areas, such as channels and borrow pits, are usually without aquatic plants of any sort. Local variations in chemical conditions of the water appear to be relatively unimportant in determining the quantity of aquatic food produced.

Intensive studies were conducted of marsh and swamp areas in Louisiana to determine the major vegetational types and their ecological relationships. Controlled water impoundment was found important in producing and making available waterfowl foods in certain marsh areas. Controlled burning associated with limited cattle grazing was also found to be a useful management practice.

Refuges were inspected and general reconnaissance of wildlife (principally waterfowl) areas was conducted in a number of other States for the purpose of recommending improvements or appraising their suitability for refuge purposes. Botanical discoveries of interest made during the course of several years of refuge reconnaissance were summarized in an article prepared for outside publication.

PREDATOR-WATERFOWL RELATIONSHIPS

Observations in waterfowl habitat indicate that under certain conditions some of the predatory enemies of ducks and geese may seriously affect their abundance. On the Crescent Lake Refuge, Nebr., the hatching success was found to be lower than on any other refuge studied intensively, owing predominantly to bull snakes. Experiments were conducted for the control of these reptiles, and some success was attained in the use of specially designed traps. At the Malheur Refuge, Oreg., nesting losses were caused principally by predators, chiefly ravens and coyotes. Studies on the Lower Souris Refuge, N. Dak., for the third successive year indicated that the skunk, still the outstanding predator affecting waterfowl on this area, should probably be further suppressed and that the mink was a more important factor than formerly. Carefully conducted crow control on this refuge seemed to have beneficial results.

The results of various nest-history studies were summarized in a paper presented at the Fourth North American Wildlife Conference, held in Detroit, Mich., in February. Including the histories of more than 7,600 nests of 13 species, the paper disclosed that on areas studied the average degree of nesting success for waterfowl is 60 percent, the chief predators, in order of importance, being skunks, bull snakes, crows, magpies, coyotes, and snapping turtles.

SUPPRESSION OF WATERCHESTNUT

For several years the Bureau has pointed out the necessity of controlling waterchestnut, or water caltrop (*Trapa natans*), in freshwater parts of the tidal Potomac River. This Eurasian plant, which is impeding shallow-water navigation, has also destroyed approximately 10 square miles of valuable waterfowl feeding grounds in the Potomac and is a serious menace to fishing, swimming, and boating. Cooperation of the War Department was obtained in undertaking a 10-year program of eradication. C. C. C. labor was made available and has successfully used manual methods in eradicating the plant from several local areas. The use of certain chemical sprays was found to be effective in control during the 2-week period immediately

prior to the earliest maturity of the fruit, which in the vicinity of Washington, D. C., is the first 10 days in July.

Studies were also made to determine the value of various chemical sprays, mowing, and water agitation as means of controlling other undesirable marsh and aquatic plants.

ARTIFICIAL PROPAGATION OF WATERFOWL

Experiments in the artificial propagation of both Canada geese and redhead ducks were undertaken to make available data relative to proper incubation and rearing techniques. Eggs that would normally have been lost in the wild were collected and electrically incubated. Information was obtained on incubation temperatures and relative humidities, stages in the development of embryos and air cells, loss of moisture, and egg anatomy. It was found that both the size of the air cell and the egg weight are good indices to the stage of development. Young birds hatched by artificial incubation were reared, and detailed measurements were taken weekly to determine age indices, which will be of value in management.

MOSQUITO CONTROL IN WILDLIFE HABITAT

Studies were continued to determine the possibility of employing biological and other methods of controlling mosquito populations in waterfowl habitat. Mosquitoes at times so menace the health and comfort of man that efforts to control them are imperative. The use of methods that are nondestructive to waterfowl has been found in many instances the best solution of a double problem—that of mosquito control and wildlife conservation.

Efforts are being made with some degree of success to control the breeding of mosquitoes in sheet water or in temporary pools by stabilizing water depths, so as to insure at all times the presence of fish and other natural enemies of mosquitoes. This sometimes involves connecting scattered pools with permanent bodies of water, which is being accomplished in most instances with little or no reduction in water levels. In setting up extensive projects for mosquito control it has become apparent that each area should be treated as an individual problem and control methods should be adapted to local waterfowl conservation or other conditions.

Continued quadrat studies in Delaware marshes, particularly in and near the Bombay Hook Refuge, showed that the desirable flora and fauna are decidedly more prevalent on natural marsh areas than on adjacent ones that are ditched. The results so far obtained indicate that drainage in that area is definitely detrimental to wildlife, since it not only removes water but eliminates all forms of life dependent directly upon it, thus having far-reaching effects on fur animals, migratory birds, and fishes. At the twenty-fifth annual meeting of the New Jersey Mosquito Extermination Association, at Atlantic City, a representative of the Bureau presented a paper on the subject, the text of which was later made available in a leaflet (BS–119). At the North American Wildlife Conference papers were presented by members of the staff under the titles "Can Mosquito Control Be Correlated with Wildlife Conservation?" and "The Effect of Lowering Water Levels on Marsh Wildlife," the latter (a technical contribution) con-

taining the results of investigations on the effects of drainage on the basic ecology of marsh areas.

LABORATORY RESEARCH IN FOOD HABITS

The 6,224 units analyzed in the food-habits research laboratory represented 149 species of amphibians, reptiles, birds, and mammals, and included the following: Stomach contents of 3,041 birds (95 species), 2,302 mammals (29 species), 237 snakes (17 species), 3 turtles (1 species), 12 lizards (1 species), and 7 salamanders (1 species); 274 droppings of mammals (6 species), 214 droppings of birds (1 species), and 98 pellets of birds (6 species); 30 den-material samples of mammals (3 species) and 5 nest-debris samples of birds (3 species); and 1 sample of material regurgitated by a bird. Many identifications of plants and seeds, insects, reptiles, bones, and hairs were made for research workers in Federal and State agencies and private institutions. Two leaflets, Outline of Procedure for Recording Data Obtained in Stomach Examinations (Bi–1515) and Preparation and Identification of Plant Specimens in the Bureau of Biological Survey (Bi–1518), were issued for the guidance of students of food habits.

BIRDS

An important contribution, Food Habits of North American Diving Ducks, was issued as Technical Bulletin 643. It is based on field studies and on analyses of the stomach contents of 6,665 adults and 140 juveniles of 22 species of inland divers and sea ducks and presents information basic to the conservation and restoration of these species.

A paper entitled "Food of Some Uncommon North American Birds," contributed to The Auk (April), discussed species that are now extinct or so rare that stomachs will no longer be obtainable for analysis. Among these were the roseate spoonbill, great white heron, trumpeter swan, emperor goose, masked bobwhite, Eskimo curlew, passenger pigeon, ivory-billed woodpecker, and Carolina parakeet. To provide correspondents with an outline of methods of attracting birds about the home grounds and with references to available literature on the subject a leaflet (BS–131) was issued. A manuscript for a Farmers' Bulletin, Attracting Birds, was returned to the Bureau at the close of the year as the publication funds were exhausted. It is planned to issue it early next year as a Conservation Bulletin of the Department of the Interior.

MAMMALS

The report on a comprehensive food-habits study of the coyote was prepared, based on the examination of the contents of 14,829 stomachs collected in 17 States over the 5-year period 1931–35. In the West, the coyote is an important predator on livestock, poultry, and desirable forms of wildlife. Offsetting its unfavorable reputation to some extent, the results of this study indicate that more than three-quarters of its feeding (on rodents and carrion) is beneficial or nonharmful to man and about one-fifth involves domestic stock, poultry, deer, and wild birds of direct economic value. At the close of the year there was in press Circular 529 on the food of the prairie

dog. Progress on a study of the food habits of bobcats was made by the analyses of 797 stomachs at the Denver laboratory.

REPTILES AND AMPHIBIANS

Investigations of the economic status of snakes in the George Washington National Forest, Va. and W. Va., were conducted by a study of 418 specimens of copperheads, timber rattlesnakes, pilot black snakes, common black snakes, hognose snakes, and common water snakes, collected through the cooperation of the Forest Service. The results were made available for publication in the Transactions of the Fourth North American Wildlife Conference. The contents of 50 stomachs of bull snakes were analyzed to determine the predatory relationship of this species to nesting waterfowl.

COOPERATIVE FOOD-HABITS RESEARCH

COOPERATIVE INVESTIGATIONS WITH WILDLIFE-RESEARCH UNITS

In cooperative research on the food habits of birds and mammals, conducted jointly with 8 of the 10 cooperative wildlife research units, 1,336 examinations were made of animals of 18 species. Three units (Alabama, Virginia, and Ohio) detailed students to perform analyses in the Bureau's laboratory at Washington, where they were aided by supervision of the headquarters staff, the central reference collections, and various laboratory facilities. Other units submitted material for examination. For the Alabama unit, 520 stomachs of 10 bird and 4 mammal species were examined. These included 220 gray foxes, 121 wild turkeys, 67 mourning doves, 27 bobwhite quails, 40 opossums, and smaller numbers of other species. A leaflet (BS–133) was issued, entitled "A Preliminary Investigation of the Food Habits of the Mourning Dove in Alabama," prepared by the Alabama organization with the aid of the Bureau. For the Virginia unit, 555 stomachs of 4 species of birds, including 269 of the bobwhite quail and 247 of the wild turkey, were examined. For the Ohio unit, the student cooperator examined 79 fox squirrel stomachs, and a report on plant histology as an aid in squirrel food-habits studies, prepared in cooperation with a staff member, was submitted for outside publication. For the Utah unit, 77 sage-hen stomachs were examined in a preliminary study of the food habits of this bird. Examinations for other units included those of stomachs of 25 ruffed grouse and 7 white-tailed deer for Pennsylvania, of 18 feral house cats and 19 skunks for Oregon, of 9 prairie chickens, 2 wild turkeys, and 7 white-tailed deer for Texas, and those of gullet samples of 15 turkey vultures for Iowa.

INVESTIGATIONS ON THE GEORGE WASHINGTON NATIONAL FOREST

Studies of ruffed grouse food habits in the mountains of Virginia were summarized in a progress report, Circular 504, entitled "Early Winter Food of Ruffed Grouse on the George Washington National Forest." The contents of 185 stomachs collected early in winter disclosed that about 85 percent of the food at this season was derived

from 20 different plants. A study of the habitats and light requirements of these plants demonstrated that wooded areas with open canopies interspersed with clearings furnish the best feeding grounds. The data obtained will be useful in improving grouse habitats in this and adjacent forests.

A related progress report on the early-winter food preferences of the wild turkey on this forest was submitted for publication in the Transactions of the Fourth North American Wildlife Conference. The nomadic feeding habits of this bird take it into diverse environments, and the ideal habitat appears to be a combination of mature forest having relatively close canopy and considerable open woodland with occasional clearings or fallow fields.

Much of the good black bear territory in Virginia is now within the boundaries of the George Washington National Forest, an area in which this mammal should be perpetuated. The results of an analysis of the early winter food showed that in this forest during the early winter season this bear is largely vegetarian. Oaks, the dominant tree growth on the forest, apparently contribute an abundance of food; deerberry and tupelo are also important.

AID TO FEDERAL, STATE, AND OTHER AGENCIES

A total of 276 unit examinations were made for the Forest Service, including stomachs of 98 snakes of 12 species, 85 ruffed grouse, 39 white-tailed deer, 16 mule deer, 16 black bears, and smaller numbers of other animals. For the Soil Conservation Service, 88 California quail stomachs, as well as a number of other bird and mammal stomachs and bird pellets, were analyzed, to aid in determining what plants have dual value as food for wildlife and as soil binders. For the National Park Service stomachs of 35 mule deer and 7 Mount Lyell salamanders were examined.

To aid the Michigan Commission of Conservation in its wildlife-management studies, 235 otter droppings and 88 stomachs of 8 other mammals, including 45 coyotes, 18 bobcats, and 17 foxes, were examined. For the Texas Game, Fish, and Oyster Commission, 13 raccoon stomachs were examined. A collaborator assigned by the New York Conservation Department analyzed the food of 89 ruffed grouse and 193 ring-necked pheasants collected in the State. For the California Department of Natural Resources, 37 stomachs of several species, mainly bobcats, were examined; for the Vermont Department of Conservation and Development, 13 bobcat stomachs; and for the New Mexico State Game and Fish Commission, a number of merganser and antelope stomachs.

Cooperation was extended to educational institutions in the analyses of the stomach contents of various birds, as follows: Several series of waterfowl and robins for Cornell University; hawks for the University of Arkansas; flickers for the University of California; 40 jacksnipes for the Illinois Natural History Survey; 26 spruce grouse for the Royal Ontario Museum of Canada; and 6 sooty grouse, 2 black brants, and 2 harlequin ducks for the Golden Gate Museum at San Francisco.

Special examinations for a number of private individuals and agencies were made of 69 stomachs, pellets, and nest-debris samples of 20 species of birds and of 44 stomachs of 3 species of mammals. Nest-

debris samples of the barred owl were analyzed for the National Association of Audubon Societies, and stomachs of 34 mule deer and 9 elk for the Federal aid in wildlife-restoration project in Colorado.

FIELD INVESTIGATIONS OF MIGRATORY GAME BIRDS

Limits of the nesting period of the white-winged dove in Arizona were investigated for the purpose of determining a suitable open season, and attention was given to the food habits and activities of the band-tailed pigeon. Of the latter, 225 stomachs were examined, bringing the available records to 350. In the San Joaquin Valley, Calif., a preliminary study was undertaken of the attack of *Protocalliphora* larvae on nesting doves, and in the Southeastern States work was continued on the food habits of the mourning dove.

STUDIES OF NUTRITION OF UPLAND GAME BIRDS

The Bureaus of Biological Survey and Animal Industry cooperated in studies to determine the nutritional requirements of the bobwhite quail and the nutritive qualities of its native foods. More than 100 breeding birds were supplied by the Virginia Commission of Game and Inland Fisheries for the experiments. At the close of the year there was in press, in the Yearbook of Agriculture, 1939, an article prepared by the Bureau on the nutrition of upland game birds.

FIELD STUDIES OF INJURIOUS BIRDS AND MAMMALS

THE CROW

The beneficial and harmful activities of the crow continued to be a controversial subject among farmers, sportsmen, and bird students. In order to obtain added information on its economic status, studies were conducted in various parts of the country. A leaflet (BS–123), entitled "Crow Damage to Fall Grain Crops in Oklahoma in 1937," was issued. Farmers' Bulletin 1102, The Crow in Its Relation to Agriculture, published in 1920, was brought to date for publication as a revised edition.

THE ENGLISH SPARROW

The manuscript for Technical Bulletin 711, entitled "The Economic Status of the English Sparrow," was submitted for publication, and an illustrated leaflet (BS–121) presenting information on the construction of home-made sparrow traps was issued.

OTHER BIRDS

Transformers used in connection with rural electrification work have frequently been put out of service because of short circuits caused by roosting birds. In cooperation with the Rural Electrification Administration and a transformer manufacturer, effective plans for altering the transformers to prevent birds from roosting on them were devised. Following an extremely dry winter season, both game and nongame species of birds inflicted serious damage to winter-grown green crops. Part 2 of a bird-control manual outlining control procedure was issued as a guide for county agricultural commissions of California.

INJURIOUS MAMMALS

The results of a study to determine the extent to which gray foxes prey upon bobwhite quail under conditions regarded as favorable to heavy predation were summarized in two reports entitled "The Summer Food Habits of Gray Foxes at the Camp Lee Quail Preserve, Virginia," and "Behavior of Gray Foxes in Raiding Quail Nests." It was found that foxes preyed upon bobwhites to some degree in this area but that their depredations were not sufficiently extensive to prevent the maintenance of a satisfactory quail population.

RESEARCH IN FUR PRODUCTION

PRESENT CONDITIONS IN FUR PRODUCTION AND THE FUR TRADE

NEED FOR PROFITABLE STOCK

Unsettled conditions in Europe and the Orient were partly responsible for a depression in the fur market, but domestic financial conditions, labor troubles, and a decline in consumer demand were contributing factors. Fur buying on a large scale is dependent on settled conditions in world affairs. Fine furs, however, which are not being produced in quantities large enough to supply the market, still command high prices.

Despite warnings from the Biological Survey, fur-animal producers for a number of years have largely sacrificed quality for quantity. Realizing now, however, that profitable stock is absolutely necessary to success, they have begun to reduce the number and improve the quality of their breeding animals. Reports indicate that many who were engaged in silver-fox raising have discontinued operations through inability to meet market requirements. This is not yet true of mink raising, and it is hoped that producers will profit by the experience of the fox breeders.

STATISTICS ON FUR PRODUCTION

After assembling data for several years on the annual production of furs in the United States, from reports of State conservation commissions and from other sources, the Bureau issued the results in a leaflet (BS–140), A Survey of the Annual Fur Catch of the United States. With the assistance of W. P. A. workers, figures on the number of predatory fur animals taken by the Bureau and cooperators from 1916 to 1938 were assembled and tabulated, the number of fur animals imported into the United States from 1931 to 1937 was compiled, and a survey of fur-animal production in captivity, including rabbit raising, was conducted. Among importations of live fur animals during the calendar year 1938 were 1,691 silver foxes, 522 minks, 8 fishers, 6 martens, and 5 nutrias, in addition to rabbits, raccoons, lynxes, and leopards. The annual summary of State laws on the trapping, possession, and sale of fur animals and their pelts or other parts was issued as a leaflet (BS–118), primarily as an aid to Federal investigators and law-enforcement officials, but also to answer inquiries constantly received from State game departments, individual trappers, conservationists, and others desiring the information.

Final arrangements have been made to include in the census of the United Otates and Alaska for 1940 questions on the number of breeding animals and young produced both by silver foxes and by minks. This will be the first comprehensive survey of the extent of fur farming, and it will come at a most opportune time. Former lack of statistical background has frequently made financial and governmental support for the industry uncertain and inadequate.

COOPERATIVE RESEARCH ON FUR ANIMALS

REPRODUCTION STUDIES

A cooperative study of reproduction in minks and muskrats was inaugurated by the Bureau with Swarthmore College, and 10 distinct experiments with a large colony of minks were carried to a successful conclusion. More than 2,500 permanent slides of vaginal smears and 600 slides of serial sections of tissue were prepared, and although much of the material, including 100 tissues, remains to be analyzed, an important finding resulted on pseudopregnancy.

The female mink ovulates only after copulation or after a fight with a male, but pregnancy may not result. In this case she experiences a period of pseudopregnancy, and since this continues until after the breeding season she cannot produce young that year. Matings or attempted matings early in the season result in a high percentage of pseudopregnancies. It was found possible to determine receptivity in a high percentage of females by a study of vaginal smears taken at 3- or 4-day intervals. One breeder reports that by using this method he had success with 84 of 85 females that accepted service. The studies also disclosed that sperms may reach the Fallopian tubes before copulation ends and that the ovarian capsule then becomes greatly engorged, functioning, apparently, as an aid in fertilization.

As an aid to understanding reproduction in the muskrat, extensive studies were made of the corpus luteum of the species in ovarian material collected on the Blackwater Refuge, Md., during the previous trapping season.

A number of articles and manuscripts, published officially and outside, reported the results of research as noted. Among the titles were the following: Fur Animal Reproductive Cycles and Their Relation to Management, The Ovum of the Mink (*Mustela vison*), Mink Breeding Through the Microscope, Physiology of Reproduction in the Mink, and Sperm Studies as a Guide in Fur-animal Breeding Practice (Leaflet BS–138). A paper on observations of corpora lutea in the ovaries of Maryland muskrats during February and March was prepared for official publication; but as funds were exhausted, it is planned to issue it early next year as a Wildlife Circular.

Study material and assistance were furnished, not only to Swarthmore College, but also to specialists of the University of Pennsylvania for work with protozoan parasites and studies of blood in respiratory transport. Additional studies were made of the respiratory adaptations of minks and their modifications for aquatic life. As a result of these investigations two papers were published: Properties of Fox Blood for Respiratory Transport and Blood Transport in the Mink.

Reporting on cooperative research undertaken with the Department of Embryology of the Carnegie Institution of Washington, Technical Bulletin 616, The Reproductive Cycle of the Coyote, was issued.

FUR ANIMAL NUTRITION

For the Yearbook of Agriculture, 1939, a chapter on nutrition of fur animals was prepared summarizing all of the experimental feeding investigations with fur animals thus far conducted by the Bureau and other agencies and including practical suggestions on feeding.

A cooperative study of the nutrition required for growth, reproduction, and fur production of foxes and minks was inaugurated by the Bureau and Cornell University. Emphasis was placed on studies of the digestibility in minks of the common feeds and feed mixtures. Digestion experiments showed that about 85 percent of the proteins of beef and horse meat are available for minks, as also are the proteins of beef tripe and udder and canned fish. In all tests the fats were more fully absorbed than were proteins, usually to the extent of more than 90 percent. Carbohydrates in the feed materials tested also were well utilized, but a large part of the crude fiber remained undigested. Analyses showed that 90 percent of the cooked starch fed with meat, either in the form of cereal grains or as a purified product, was digested. The digestibility of the carbohydrates of cooked and raw cereal is being given further study. Toward the end of the year similar tests with foxes were begun.

In an experiment undertaken to determine the vitamin-A requirements for the maintenance of adult minks, six animals were maintained for 5 months on a ration devoid of that vitamin, except as supplied by frozen horse meat. X-ray photographs were taken monthly to determine whether bladder stones had developed, but nothing abnormal was observed.

In observations on the nitrogen requirements of adult minks, it was found that rations containing more than 14 percent of protein and supplying at least 2 grams of nitrogen each 24 hours permitted nitrogen re-storage by the body, but that those containing only 6 percent of protein resulted in negative nitrogen balances. Additional work must be done to establish the minimum nitrogen requirement for maintenance.

FUR-FIBER INVESTIGATIONS

At the Agricultural Research Center, a study was begun in cooperation with the Bureau of Animal Industry to determine by microscopical examination the physical properties of fur and the factors that contribute to the production of fur of superior quality. Special attention was given to fur fibers of the silver fox, mink, marten, and Karakul sheep. A review was made of all the American and foreign literature covering similar investigations.

Through persistent research, media have been found that are suitable for making both temporary and permanent mounts to reveal the inner structure of the fibers, especially pigmentation, and to emphasize their outlines. In heavily pigmented and medullated fibers fine relationships between scales cannot be distinguished by direct observation, and in such cases the details were revealed by casts and

photomicrographs. The precision of this method will undoubtedly prove of importance in the identification of unknown fibers.

KARAKUL SHEEP AND OTHER INVESTIGATIONS

The study of Karakul sheep, which is cooperative with the Bureau of Animal Industry, gave particular attention to the selection of typical specimens illustrating size and type of curl, pattern, and luster. The year's crop of 53 lambskins, after being graded and valued according to the standard samples, was taken by a Survey representative to fur-trade specialists who also appraised them. A survey completed by W. P. A. workers under the direction of the Bureau revealed that there were 5,389 purebred and grade Karakul sheep on American farms on January 1, 1938, from which 1,051 Karakul lamb pelts were produced in 1937. Importations ran over a quarter of a million. American producers supply less than 0.5 percent of the lambskins used by the fur trade.

In cooperative research with the Bureau of Chemistry and Soils, observations were made on the effect of alternate freezing and thawing of silver fox skins immediately following pelting. No appreciable difference in either the tensile or bursting strength of the frozen and unfrozen skins was detected.

On request of the Federal Trade Commission, information concerning the real and trade names of furs, as well as information regarding fur-trade practices in general, was supplied for use in enforcing the fair-trade-practice rules for the fur industry. During this first year of operation of the rules the Commission handled over 500 cases of alleged misdescriptive advertising and made much progress in correcting the bad practices against which the rules were directed.

The Treasury Department was assisted in proceedings before the Court of Customs and Patent Appeals between the Federal Government and fur importers, Bureau representatives furnishing scientific and other data for use in preparing the cases, in which duties amounting to many millions of dollars are involved.

FUR ANIMAL EXPERIMENT STATION, N. Y.

The construction program at the Fur Animal Experiment Station, Saratoga Springs, N. Y., which was made possible by W. P. A. funds, has been in operation for 2 years, and its completion is expected during the coming year. The station property was enclosed with a 6-foot chain-link fence, the residence for the director was completely remodeled, two large colony houses for minks were constructed, additional fox and marten pens were completed, and the premises were graded and landscaped. Although this work has retarded the research program to some extent, the improvements when completed will provide much better facilities for administrative and experimental work. Extended experiments were conducted with foxes, minks, and martens in testing the merits and relative costs of various feed preparations.

A search for more humane, efficient, and economical methods of killing foxes was continued. Technique developed at the station some years ago for electrocuting fur animals, together with improved

equipment, was found to operate quickly and humanely. Time records under this method kept on 24 foxes showed that death occurred within 2.7 to 6.7 seconds.

Reports on studies included three leaflets, An Efficient Trap for the Fox Ranch (BS–127), A Feeder for Foxes (BS–128), and Seasonal Fox Rations and Quantities to Feed (BS–130). The director of the station made an address on research work with fur animals at the annual short course for fur-animal breeders at the Ontario Veterinary College, Guelph, Ontario.

RABBIT EXPERIMENT STATION, CALIF.

Increasing number of rabbit breeders and of 4–H Club members, Future Farmers, and high-school and college students interested in raising rabbits visited the Rabbit Experiment Station, Fontana, Calif., for advice and special instruction on breeding, feeding, and management. The fourth annual field day, held at the station on May 21, was attended by 350 southern California rabbit breeders. Requests for information from breeders from practically every State and from several foreign countries, as well as from feed mills relative to rabbit rations, increased in volume.

Based on results of feeding experiments, a leaflet (Bi–1520), Rabbit Rations and Quantities to Feed, was prepared for answering correspondence from various sections relative to rations for herd bucks, does and litters, dry does, and young being developed for breeding purposes. Extensive experimental research demonstrated that rabbits require higher protein content in their diet than was formerly considered necessary.

Twenty-five different rations were used in the experimental herd in connection with mucoid-enteritis studies, and considerable variation in mortality occurred in the different lots. Present information suggests that the vitamin content of the ration and the quality of roughage are fertile fields for future research.

An experiment was begun to obtain fundamental knowledge as to the effect of the woolly gene on the quality and commercial value of rabbit fur and pelts and on the development of the animal and the quality of carcass.

Special equipment was developed for housing rabbits in desert and other areas where high temperatures prevail and water is unavailable for controlling rabbitry temperatures. Outdoor hutches, each equipped with an underground compartment in which the temperature averages about 15° to 20° F. lower than that of the hutch and in which the floor space is about half that of the hutch, were found adequate for accommodating doe, litter, and nest box. In a 2-year study with this type of equipment, when maximum temperatures reached 108° to 117° F. no heat mortality was noted.

Information developed on breeding, feeding, and management, and on equipment for the rabbitry was prepared for revising Farmers' Bulletin 1730, Rabbit Production. The results of several years of experimental studies with various types of hutch floors were reported in a leaflet (BS–139), Rabbit Pen Construction in Relation to Sore Hocks. Several papers based on nutritional studies were prepared for rabbit journals, farm papers, and industrial bulletins. An article on feed requirements of rabbits was prepared for the World's

Poultry Congress, held in Cleveland, Ohio, in July 1939. The director of the station reported on the experimental program in addresses given at the National Convention of Rabbit Breeders, in Columbus, Ohio, and at rabbit clubs at Chicago, Ill., and San Diego and Los Angeles, Calif.

FUR ANIMAL FIELD STATION, MD.

Fur animals occur naturally on many of the national wildlife refuges, where they must be managed so as not to jeopardize migratory waterfowl and the resident species of upland game birds and mammals. The pelts of fur animals have such high commercial value that a considerable income can be realized from fur on all these refuges. Fur animals produced there are valuable also for restocking as well as for scientific study in obtaining fundamental knowledge not otherwise available. On the Blackwater Refuge, Md., the Fur Animal Field Station is gaining definite knowledge on breeding seasons, prime fur periods, feed requirements, carrying capacity of marsh areas, and many other practical problems in the management of fur resources on Federal refuges in general.

Another careful count of all muskrat houses on the entire Blackwater marsh area of 5,406 acres was made in an effort to correlate pelt production and house density per acre. The houses, old and new, large and small, totaled 29,893. The annual catch of 21,856 pelts, segregated by color and by trapping areas, showed 9,896 black, 10,370 brown, and 1,590 kit and damaged pelts.

Twelve 100-foot-square quadrats were staked out last August in various types of marsh selected for a study of the changes taking place in plant growth. Each of the quadrats was photographed, and a detailed study was made of the vegetation and the abundance of muskrats. Additional muskrat pens and enclosures were constructed, and much attention was given to the factors affecting muskrat breeding in captivity, including size of pen, presence or absence of water, types of nest boxes, heat, drought, feeds, disturbing noises, handling, and polygamous and monogamous mating.

Of a large variety of truck and field-crop plants fed to determine the likes or dislikes of muskrats, the feeds most relished were carrots, crimson clover, green pea vine, hairy vetch, corn, raw peanuts in the shell, live and dead minnows, and live crabs.

A pair of nutrias, 6 months old, purchased and placed in a pen on the refuge, produced five young on March 2 and were expected to produce a second litter in August. Further observations and studies of this South American rodent are planned to determine its suitability as a fur producer in marsh areas of the United States.

RESEARCH IN WILDLIFE-DISEASE CONTROL

FUR-ANIMAL DISEASES

Research on experimental test animals, correlated with results obtained on cooperating commercial fur farms, added to the knowledge of epizootic diseases and developed facts for application in restricting serious losses. Until recently, inadequate laboratory facilities made it necessary to test on the operating farms of collaborators biological products designed for disease control, and frequently the

results thus obtained were found more useful than experimental findings in the laboratory alone. The possibility of accidental outbreaks among valuable stock where these tests were being conducted made it necessary to proceed with great caution and to extend the investigations over a period of years.

SILVER FOX DISTEMPER

Since homologous serum alone does not produce lasting immunity against canine distemper in silver foxes, efforts were made to determine the value of other biological control preparations. Tissue vaccines from several sources were administered experimentally to supplement the transitory protection of the serum. The results demonstrated the value of using chemically treated tissues containing the virus. Experimental research was conducted along this line for reducing losses from distemper, and plans were made for checking the use of phenol-, choloroform-, and formalin-treated tissues and the attenuation of the live viruses in such manner as to safeguard their use and make them productive of long-time protection. Research conducted in cooperation with the University of Minnesota facilitated accurate diagnosis.

MINK DISTEMPER

In collaboration with outside institutions and fur farmers in investigations of distemper in minks, formolized tissue vaccine was given extensive tests. Administered under proper conditions, this new product was shown to have considerable protective value. Tests also are under way to ascertain possible variations in distemper virus from different sources and from various species of animals.

RABBIT DISEASES

Field tests in specially constructed and screened hutches demonstrated the transmission of the virus of myxomatosis by mosquitoes. Although popularly believed to be a mosquito-borne disease, this was the first scientific evidence that myxomatosis is transmitted in epizootic form by these insects. The fact that the disease is of seasonal occurrence suggests that wild rodents may serve as a reservoir for the infection and that it is carried to domestic rabbits when mosquitoes are prevalent. Efforts are being made to determine the host or hosts that carry the infection from one season to another.

During the past year heavy losses were caused by a disease, apparently new in commercial rabbitries, spoken of as hemorrhagic enteritis. Bacteriologists at the University of California at Los Angeles are aiding in a study of its etiology, but no specific organism has yet been isolated that will reproduce the disease in test animals.

GAME-BIRD DISEASES

BOTULISM IN WATERFOWL

Research was continued at the Bear River Refuge, Utah, on factors responsible for widespread losses for botulism. A significant finding was that various forms of vegetation have a marked effect on the development and accessibility of the toxin produced by the causative

organism (*Clostridium botulinum*) so that the establishment of desirable types of plants that inhibit the growth of this organism may now be recommended. To be encouraged are submerged types of vegetation that in rapid growth liberate oxygen freely and so check the growth of the anaerobic germ. To be discouraged are *Cladophora* and like algae, as the rapid decay of these plants and of the abundant minute forms of animal life enmeshed in them furnishes favorable media for the organism's growth.

A leaflet (BS–120) entitled "Botulism, a Recurring Hazard to Waterfowl," was issued to give a history of the outbreaks of this disease and offer suggestions for safeguarding waterfowl, and a paper on American vultures and the toxin *Clostridium botulinum* was prepared for the Journal of American Veterinary Association.

Observations made on Malheur Lake and other areas in southeastern Oregon indicate that the presence of livestock may be helpful in preventing outbreaks of botulism, presumably by agitating the water and thereby preventing local concentrations of toxin.

OMPHALITIS IN UPLAND GAME BIRDS

Outbreaks were investigated of a disease attacking young game birds raised on propagating farms. This infection, omphalitis, recognized as a plague in domestic chicks, also becomes epizootic among young chukar partridges and quails. Although cures are impracticable, good results in prevention were obtained through fumigation of incubator rooms and brooders. With care, the incubator and the room in which it is kept may be effectively fumigated while in operation.

FEDERAL AID IN WILDLIFE RESTORATION

The Federal Aid to Wildlife Restoration Act (50 Stat. 917), also known as the Pittman-Robertson Act, became effective on July 1, 1938, with an appropriation of $1,000,000, and progressed satisfactorily during the year. The program thereunder has had excellent support from all conservation agencies and organizations, and it is expected that when fully operative it will have far-reaching effects on the Nation's wildlife resources. A new Division of Federal Aid in Wildlife Restoration was organized to handle the details of the program, and regional inspectors were appointed to cooperate closely with the State game departments in examining proposals and assisting the States in operations under the act. The text of the regulations for carrying out the act was published in Service and Regulatory Announcement B. S. 91, and the purpose of the act and the procedure thereunder in Miscellaneous Publication 350, The Wildlife Restoration Program Under the Pittman-Robertson Act of 1937.

The act authorizes annual appropriations of not to exceed the excise tax on sporting arms and ammunition, which yielded a revenue of $2,976,019 this year. The funds appropriated are apportioned to each State on the basis of its area and the number of its hunting-license holders. The allotments may be obligated for a 2-year period, after which unexpended and unobligated balances are to be made available for carrying out the provisions of the Migratory Bird Conservation Act. The States contribute 25 percent of the cost of their wildlife restoration projects, each of which, to be approved, must be substan-

tial in character and design. The projects include research into problems of wildlife management and restoration of areas of land or water to provide additional benefits for wildlife. All lands purchased are owned by the States and are to be maintained by them. The fish and game commissions are named as the cooperating State agencies.

The act provides that no State may participate until it has passed laws for the conservation of wildlife, including a prohibition against the diversion of hunting-license fees to any other purpose than the administration of the State fish and game department, and until it has assented to the provisions of the act, except that until the final adjournment of the first regular session of the State legislature held after the passage of this act, the assent of the Governor is sufficient.

During the first year of the operation of the act, 43 States became eligible for participation—in 42, legislation was adopted assenting to the provisions of the act; and in 1, a bill was introduced and awaits action by the legislature still in session. Only 5 States—Florida, Georgia, Louisiana, Montana, and Nevada—failed to enact laws necessary to permit participation. In all, 87 projects, many extending beyond the present fiscal year, were submitted by 37 States. These would require $1,819,819 for completion. Of the $1,000,000 appropriated to carry out the provisions of the act in its first year, $343,932 was set aside in the Federal Treasury to cover 58 projects approved in 31 States. Final approvals of the 29 others were delayed, pending further investigations.

The types of projects were as varied as the problems of the State game departments. Of the 87 submitted, 30 involved research in wildlife management; 28, development of natural conditions for wildlife; 28, acquisition of lands by purchase or lease; and 1, a combination of research and development. The features for each State are shown in table 2.

TABLE 2.—*Nature, extent, and estimated cost of initial Federal aid in wildlife restoration projects*

State, available 1939 funds,[1] and type of project	Purpose	County	Years duration	Cost estimate	
				First year	Total
Alabama ($17,884):					
Research	To inventory the principal wildlife species.[2]	All	3	$8,480	$30,700
Arizona ($24,816):					
Research	To determine factors limiting the wild turkey.	do	1	7,565	7,565
Development	To reclaim abandoned well to supply water for desert wildlife.	Maricopa	1	255	255
Do	To reestablish wild turkey breeding stocks.	Pima, Cochise, Graham.	1	775	775
Colorado ($29,918):					
Research	To study summer-winter food of deer and elk.	All	1	6,945	
Do	To select sites for reestablishing beaver colonies.	do	1	2,396	2,396
Acquisition	To purchase winter range for deer and elk.[2]	Gunnison	2	13,940	19,280
Delaware ($1,821):					
Research	To determine the value of seedstock areas in maintaining wildlife.	All	5	1,821	16,000

[1] State supplied 25 percent, Federal Government 75 percent.
[2] Project under consideration at end of year.

TABLE 2.—*Nature, extent, and estimated cost of initial Federal aid in wildlife restoration projects*—Continued

State, available 1939 funds,[1] and type of project	Purpose	County	Years duration	Cost estimate	
				First year	Total
Florida ($16,319):					
Research	To determine the possibilities of a wildlife-restoration program.	All	5	$2,400	
Idaho ($23,788):					
Development	To improve sage grouse habitat [2]	do	1	6,560	$6,560
Do	To transplant beavers from overpopulated to underpopulated areas.[2]	do	1	10,349	10,349
Research	To determine the effect of beavers on range lands.[2]	Ada, Elmore, Owyhee.		3,676	3,676
Illinois ($34,853):					
Research	To make economic survey of fur resources.	7	2	1,793	4,865
Do	To study the correlation between availability of food supplies and their use by game birds.	All	2	2,989	5,100
Do	To study game and fur management methods on farms.[2]	Champaign	4	880	11,000
Do	To study the effect of management practices on wildlife concentrations on refuges.[2]	Cumberland	4	900	10,680
Do	To study waterfowl and upland-game management.[2]	Lee			2,100
Acquisition	To purchase refuge for upland game.[2]	Cumberland	1	13,002	13,002
Do	To purchase waterfowl and upland-game refuge.[2]	Lee	1	63,180	63,180
Development	To improve food and cover on farm lands.[2]	Champaign	4	2,236	3,265
Do	To improve habitat on wildlife refuge.[2]	Cumberland	4	3,233	4,344
Do	To improve waterfowl and upland-game refuge.[2]	Lee			35,710
Indiana ($44,280):					
Acquisition	To purchase refuge for upland game and migratory waterfowl.	Posey	1	20,600	20,600
Iowa ($22,479):					
Acquisition	To purchase waterfowl, fur-animal, and upland-game refuge.[2]	Worth, Winnebago	2		27,641
Kansas ($22,546):					
Acquisition	To purchase additional lands for established State game preserve.	Finney	1	9,450	9,450
Kentucky ($16,208):					
Acquisition	To purchase deer and upland-game refuge.	Pike	1	5,570	5,570
Do	do	Harlan	1	10,637	10,637
Maine ($14,708):					
Research	To determine measures for improving lakes for wildlife.	All	4	2,892	22,633
Development	To improve lakes as recommended from research.	do	4	5,866	50,907
Massachusetts ($7,779):					
Research	To determine means of improving winter conditions for waterfowl.	4	5	5,000	25,000
Development	To improve wildlife areas on State forest.	Norfolk	1	1,604	1,604
Do	do	Hampshire	1	1,175	1,175
Michigan ($67,577):					
Research	To determine effective raccoon-management practices.	Allegan	2	2,192	4,720
Do	To coordinate game-management and farm practices.	Clinton	3	1,625	5,000
Acquisition	To purchase refuge for wildlife [2]	Tuscola	3		118,420
Do	To purchase addition to Rose Lake Wildlife Experiment Station.[2]	Clinton, Shiawassee	3		144,630
Minnesota ($35,136):					
Acquisition	To purchase addition to Carlos Avery Refuge.	Anoka	1	9,703	9,703
Do	To purchase addition to Thief Lake Waterfowl Refuge.	Marshall	1	960	960

[1] State supplied 25 percent, Federal Government 75 percent.
[2] Project under consideration at end of year.

TABLE 2.—*Nature, extent, and estimated cost of initial Federal aid in wildlife restoration projects*—Continued

State, available 1939 funds,[1] and type of project	Purpose	County	Years duration	Cost estimate	
				First year	Total
Minnesota ($35,136)—Continued.					
Development	To fence and post Carlos Avery Refuge.	Anoka	1	$2,920	$2,920
Do	To restore waterfowl and upland game on State refuges.[2]	4	5	21,553	55,077
Mississippi ($18,366):					
Development	To plant food and cover on State game preserve.	Hinds	1		267
Do	To improve food and cover and to stock national-forest wildlife areas with deer, turkey, and beaver.	4	5	11,777	41,187
Missouri ($26,998):					
Research	To survey wildlife resources	All	5	26,400	132,000
Nebraska ($27,238):					
Development	To restock and improve cover for pheasants.	do	5	13,720	
New Hampshire ($6,180):					
Research-development	To undertake experimental stocking and cover improvement on research area for pheasants, grouse, ducks, and fur animals.	Merrimack	5	6,180	34,029
New Jersey ($12,559):					
Research	To study the effectiveness of refuges in maintaining wildlife.	Warren, Hunterdon	2	2,801	3,250
Acquisition	To lease seed-stock refuges for upland game.	Warren	1	1,237	1,237
Do	To lease land for establishing food patches for deflecting deer from farm crops.[2]	Atlantic	1	605	605
Development	To plant food and cover for upland game.	Warren	1	3,611	3,611
Do	To plant food crops to deflect seasonal movements of deer from farms.	Atlantic	1	3,674	3,674
New York ($65,944):					
Research	To study management methods for pheasants, cottontail rabbits, white-tailed deer, mallards, and black ducks.	All	5	25,348	142,452
Acquisition	To purchase addition to Delmar Wildlife Research Center.	Albany	1	9,320	9,320
Do	To lease upland-game and fur-animal seed-stock refuges.	All	1	7,717	7,717
Development	To construct pathological laboratory on Delmar Wildlife Research Center.[2]	Albany	1	9,405	9,405
Do	To improve seed-stock refuges for pheasants, cottontail rabbits, raccoons, and muskrats.	All	1	3,340	3,340
Do	To revegetate State lands deficient in food and cover for wildlife.	16	10	5,333	96,980
North Carolina ($23,224):					
Development	To construct 2 dams to impound water for attracting wintering waterfowl, upland birds, and fur animals.	Richmond	1	3,018	3,018
Research	To study farm-game management.	Wake	5	9,953	55,873
North Dakota ($15,322):					
Acquisition	To purchase refuge for pheasants, grouse, partridges, and waterfowl.[2]	Kidder			5,020
Ohio ($52,023):					
Acquisition	To purchase refuge for waterfowl and upland game.[2]	Erie	2	52,023	60,045
Oklahoma ($21,137):					
Development	To restore bobwhite quail and undertake its management.	All	1	18,860	18,860

[1] State supplied 25 percent, Federal Government 75 percent.
[2] Project under consideration at end of year.

TABLE 2.—*Nature, extent, and estimated cost of initial Federal aid in wildlife restoration projects*—Continued

State, available 1939 funds,[1] and type of project	Purpose	County	Years duration	Cost estimate	
				First year	Total
Oregon ($25,667):					
Development	To transplant beavers from overpopulated to underpopulated areas.	All		$4,899	
Do	To restore sage grouse habitat	Southeastern		5,200	
Pennsylvania ($61,368):					
Research	To make economic survey of fur animals.	All	1	3,500	$3,500
Acquisition	To purchase land for game-management and refuge areas.	9	1	48,883	48,883
Do	do	Cumberland	1	8,985	8,985
Rhode Island ($972):					
Research	To study game management on demonstration areas.	Washington	5	575	5,250
Tennessee ($14,247):					
Acquisition	To purchase preserve for deer, wild turkeys, quails, raccoons, opossums, and other wildlife.	Cheatham	5–10	14,247	86,748
Texas ($61,652):					
Research	To survey wildlife resources	All	5	53,600	300,000
Utah ($21,155):					
Research	To study beaver management and stream run-off.	Summit	3	3,000	9,000
Development	To improve waterfowl conditions at Ogden Bay.	Weber	1	16,000	16,000
Acquisition	To purchase winter range for deer.[2]	Millard			77,500
Do	To purchase experiment station for deer studies.[2]	Cache	1	2,000	2,000
Vermont ($5,766):					
Research	To study bird migrations, food and cover needs, and protective measures.	All	5	5,000	25,000
Virginia ($19,637):					
Research	To learn the distribution of wild turkeys and factors influencing their abundance.	do	2	1,690	5,000
Do	To study the effect of cleared areas on wildlife populations.	do	2	950	7,575
Development	To reestablish deer on and near the Thomas Jefferson and George Washington National Forests.	12	1	10,702	10,702
Do	To restock with wild turkeys	Giles, Smyth	1	320	320
Do	To restore bobwhite quail[2]	Clarke, Loudon, Fauquier.	1	2,110	2,110
Washington ($31,253):					
Acquisition	To purchase winter range for deer.[2]	Okanogan	1	31,248	31,248
West Virginia ($19,884):					
Acquisition	To purchase game-management area.	Hampshire	1	17,540	17,540
Wisconsin ($31,652):					
Research	To learn reasons for fluctuations in quail populations.	Columbia	5	200	1,000
Acquisition	To purchase demonstration and research area.[2]	do	2	31,452	54,457
Wyoming ($20,934):					
Research	To study factors determining the abundance of Rocky Mountain bighorn sheep.	4	5	3,776	25,000
Do	To study moose-management factors in northwestern Wyoming.[2]	5	4	4,451	20,000
Acquisition	To purchase land for game refuge.[2]	Albany	3	12,000	22,500
Do	To purchase South Park Elk Feeding Ground.[2]	Teton	1	6,930	6,930

[1] State supplied 25 percent, Federal Government 75 percent.
[2] Project under consideration at end of year.

The 30 research projects were restricted to practical problems of management, including State-wide game surveys on which to base future development and management programs; studies of the rela-

tion of summer and winter ranges of big game; methods of quail, turkey, and deer management; investigations of local migrations of waterfowl; studies of factors influencing turkey populations; coordination of game-management and farming practices; management of fur resources; research on factors influencing the population of raccoons; and investigation of factors limiting herds of mountain sheep. Some worth-while results were obtained within the few months the program was under way.

The 28 development projects for improving natural conditions for wildlife covered such matters as restoring water facilities for desert game; fencing surrounding lands and developing springs to provide additional food and cover for wildlife as well as to increase the water supply for livestock; propagating food and cover plants to improve wildlife habitat on State and Federal lands; posting and fencing refuges; releasing seed stocks of game on protected areas; trapping and planting live beavers and turkeys; constructing dikes to control water on areas used by migratory birds and fur animals; and purchasing deer from States having surpluses and transporting them to protected areas deficient in seed stock.

The acquisition projects, involving the purchase or lease of lands, progressed more slowly at the start than projects of other types because of the greater time and effort needed. Of the 28 submitted, substantial progress was made on 13, involving cut-over woodlands to be dedicated to wildlife use in the Eastern and Southern States, winter range for big game in parts of the West, agricultural lands for conducting studies of the relation of farming practices to wildlife populations, and additional lands for increasing research facilities.

REFUGE-LAND ACQUISITION

Following approval of purchase by the Migratory Bird Conservation Commission, 1 new refuge of 8,000 acres was added to the national wildlife refuge system; 6 new refuges with an aggregate area of 1,521,376 acres were set aside from the public domain; and 22 refuges were enlarged through the acquisition of lands aggregating 18,539 acres.

By Executive orders increments to 5 refuges heretofore established in public-domain States were obtained by the inclusion of a total of 21,787 acres; and Executive orders were issued also for the establishment of 59 new refuges, enlargement of 8 existing refuges, and correction or modification of scope of 2 others, including 1,749,163 acres of the public domain and 132,304 acres acquired by purchase.

There have also been added to the refuge system 332,438 acres in 7 units, which were acquired by the Farm Security Administration and more recently handled by the Soil Conservation Service. Five of these refuges, namely, Carolina Sandhills, S. C.; Little Pend Oreille, Wash; Piedmont, Ga.; Moosehorn addition, Maine; and Kentucky Woodlands, Ky., aggregating 269,938 acres, are primarily suitable for upland game; while the Necedah, Wis., and St. Marks addition, Fla., containing 62,500 acres, are migratory-waterfowl refuges.

Details of the accomplishments in refuge-land acquisition are given in table 3.

TABLE 3.—*Land for refuges and related uses acquired or in process of acquisition during the fiscal year 1939 under the Migratory Bird Conservation Act, with emergency and other funds, by gifts, and by Executive order*

State and county	Refuge	Under Migratory Bird Conservation Act			With emergency and other funds			Acquired other than by purchase	Total	Acquired in previous years
		Acquired by purchase	Pending title conveyance	Total	Acquired by purchase	Pending title conveyance	Total			
		Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Alabama: Limestone, Madison, and Morgan.	Wheeler							[1] 41,800	41,800	
Arizona:										
Pima and Yuma	Cabeza Prieta							[1] 860,000	860,000	
Yuma	Kofa							[1] 660,000	660,000	
Arkansas: Arkansas, Desha, Monroe, and Phillips.	White River		6,232	6,232	3	1,417	[2 3 4] 1,420		7,652	103,036
Delaware: Kent	Bombay Hook		1,704	1,704					1,704	12,006
Florida:										
Pasco and Pinellas	Anclote [5]							[1] 155	155	
Hillsborough	Fort DeSoto							[6] 421	421	
Monroe	Great White Heron							[1] 1,000	1,000	
Jefferson, Taylor, and Wakulla	St. Marks	3,482	1,803	5,285		1,182	[2] 1,182	[7] 22,000	28,467	50,778
Georgia:										
Charlton, Clinch, and Ware	Okefenokee		833	833				[8] 16	849	292,993
Jasper and Jones	Piedmont							[7] 58,400	58,400	
Chatham	Savannah River (see also South Carolina).									5,414
Effingham	Wilson Sanctuary							[8] 1,426	1,426	
Idaho: Jefferson	Camas	1,310	533	1,843					1,843	8,691
Illinois:										
Mason	Chautauqua					496	[3 4] 496		496	3,981
Carroll, Jo Daviess, Rock Island, and Whiteside.	Upper Mississippi (see also Iowa, Minnesota, and Wisconsin).									5,256
Iowa:										
Kossuth	Union Slough	80	441	521					521	630
Allamakee, Clayton, Clinton, Dubuque, Jackson, and Scott.	Upper Mississippi (see also Illinois, Minnesota, and Wisconsin).									24,441
Kentucky: Lyon and Trigg	Kentucky Woodlands							[7] 47,066	47,066	
Louisiana:										
Plaquemines and St. Bernard	Breton							[1] 25,000	25,000	955
Plaquemines	Delta		7,092	7,092	10,361		[2] 10,361		17,453	34,300
Cameron	Lacassine	58	2,574	2,632					2,632	28,720
Maine: Washington	Moosehorn		439	439				[7] 5,872	6,311	11,293

See footnotes at end of table.

TABLE 3.—*Land for refuges and related uses acquired or in process of acquisition during the fiscal year 1939 under the Migratory Bird Conservation Act, with emergency and other funds, by gifts, and by Executive order*—Continued

State and county	Refuge	Under Migratory Bird Conservation Act			With emergency and other funds			Acquired other than by purchase	Total	Acquired in previous years
		Acquired by purchase	Pending title conveyance	Total	Acquired by purchase	Pending title conveyance	Total			
		Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Maryland: Anne Arundel and Prince Georges.	Patuxent		432	432					432	2,693
Michigan: Schoolcraft	Seney	9,892	17,331	27,223	39		[2] 39		27,262	58,143
Minnesota:										
Aitkin	Rice Lake	1,423	1,550	2,973	4,731	123	[2] 4,854		7,827	3,597
Cottonwood	Talcot Lake					885	[8] 885		885	80
Becker	Tamarac	520	1,826	2,346					2,346	21,921
Houston, Wabasha, and Winona	Upper Mississippi (see also Illinois, Iowa, and Wisconsin).					1,874	[9] 1,874		1,874	14,478
Missouri:										
Stoddard and Wayne	Mingo		25,000	25,000					25,000	
Holt	Squaw Creek	1	162	163	160		[10] 160		323	6,581
Chariton	Swan Lake	1,370	1,581	2,951	18		[2] 18		2,969	7,793
Montana:										
Roosevelt and Sheridan	Medicine Lake				341	2,416	[2] 2,757		2,757	20,960
Beaverhead	Red Rock Lakes					7,209	[2] 7,209		7,209	24,965
Nebraska: Cherry	Valentine				1		[2] 1		1	65,283
Nevada:										
Humboldt and Washoe	Charles Sheldon (see also Oregon).	80	5,699	5,779					5,779	576,404
Elko and White Pine	Ruby Lake	15,729	40	15,769				[1] 7,166	22,935	12,683
New Jersey: Atlantic	Brigantine		8,000	8,000					8,000	
New Mexico:										
Chaves	Bitter Lake [5]		7,415	7,415					7,415	14,549
Socorro	Bosque del Apache		2,928	2,928					2,928	52,843
New York:										
Suffolk	Fort Tyler							[1] 14	14	
Seneca	Montezuma [5]	283	3,068	3,351				[8] 12	3,363	2,564
North Carolina:										
Hyde	Lake Mattamuskeet	219		219					219	49,925
Dare	Pea Island	2,702		2,702					2,702	3,177
North Dakota:										
Foster and Stutsman	Arrowwood				6	65	[2 3 4] 71		71	13,235
Burke and Ward	Des Lacs				282	239	[2] 521		521	13,500
Ramsey	Lake Alice		10	10					10	
Burleigh and Kidder	Long Lake		240	240					240	7,048
Burke and Mountrail	Lostwood	31	6	37	471		[2] 471		508	22,899

Bottineau and McHenry	Lower Souris	1,368	898	2,266	1,739		[2 3 4] 1,739		4,005	53,929
Renville and Ward	Upper Souris	28	680	708	160	102	[2] 262		970	30,677
Ohio: Lucas	West Sister Island							[1] 82	82	
Oklahoma: Alfalfa	Salt Plains							[1 11] 6	6	19,453
Oregon:										
Tillamook	Cape Meares							[1] 139	139	
Lake	Charles Sheldon (see also Nevada).		627	627					627	
Do	Hart Mountain		7,524	7,524					7,524	214,514
Harney	Malheur: Blitzen unit		320	320					320	65,842
South Carolina:										
Chesterfield	Carolina Sandhills							[7] 102,000	102,000	
Jasper	Savannah River (see also Georgia).	617		617					617	6,608
South Dakota:										
Brown	Sand Lake				11	320	[2] 331		331	19,465
Day	Waubay	29		29					29	2,557
Tennessee: Lake and Obion	Lake Isom					1,517	[2] 1,517		1,517	20
Texas:										
Aransas	Aransas		855	855				[1] 8,000	8,855	45,917
Bailey	Muleshoe				1,440		[2] 1,440		1,440	4,369
Utah: Box Elder	Bear River [5]	39		39					39	57,126
Vermont: Addison	Morgan Farm							[10] 952	952	
Virginia: Princess Anne	Back Bay	663		663					663	3,926
Washington:										
Stevens and Pend Oreille	Little Pend Oreille							[7] 56,600	56,600	
Spokane	Turnbull	560	3,176	3,736					3,736	7,905
Pacific	Willapa Harbor		198	198					198	2,770
Wisconsin:										
Juneau	Necedah							[7] 40,500	40,500	
Buffalo, Crawford, Grant, LaCrosse, Trempealeau, and Vernon.	Upper Mississippi (see also Illinois, Iowa, and Minnesota).					321	[9] 321		321	54,502
Wyoming:										
Teton	Elk Refuge [5]	80	620	700					700	19,877
Albany	Hutton Lake	40		40					40	1,401
Total		40,604	111,837	152,441	19,763	18,166	37,929	1,938,627	2,128,997	([12])

[1] Set aside by Executive order or proclamation.
[2] Federal Emergency Relief Administration and Resettlement Administration funds.
[3] $1,000,000 fund provided through Executive Order No. 6724, of May 28, 1934.
[4] $950,000 fund, a substitute for Executive Order No. 6724.
[5] In addition to the acreage shown, the Bureau holds 4,154.61 acres under lease on these refuges.
[6] Turned over to the Bureau by Act of Congress.
[7] Purchased by Farm Security Administration; originally intended for agricultural demonstration areas, but transferred to this Bureau.
[8] Acquired by gift.
[9] Upper Mississippi River Wildlife and Fish Refuge fund.
[10] Item in the Second Deficiency Act of 1938.
[11] Erroneously shown in report for fiscal year 1938; actually acquired by Executive order dated July 5, 1938.
[12] Total omitted, as entries in column are for only those refuges on which acquisition work was involved during the year.

NOTE.—1-acre items range from a fraction of an acre to 1.49 acres.

In addition to activities in dedicating land for wildlife refuge purposes, the year was notable for State cooperation, the legislatures of Virginia and Maryland having consented to the segregation as national sanctuaries of water areas important to migratory wild fowl. In Virginia an extensive body of water contiguous to lands heretofore acquired by the Biological Survey in Back Bay was made an inviolate sanctuary, and in Maryland action of the same nature was taken on the Susquehanna Flats, a considerable part of which will later become a Federal refuge. No other bodies of coastal waters in the United States are more important than these as concentration places for migratory game birds. Increasing land-acquisition effort must be devoted to the procurement of more or less restricted bodies of land found to be desirable for rounding out or consolidating areas heretofore brought into Government ownership. Sometimes this can be accomplished by purchase after mutually satisfactory agreements on price have been reached, but in the majority of cases, to establish an equitable compensation, recourse must be had to court proceedings.

In 27 condemnation proceedings conducted in Federal courts in 17 States, land-valuation experts of the Bureau appeared as witnesses. Probably the most noteworthy single accomplishment was the favorable outcome of the condemnation proceedings for the acquisition of lands necessary to complete the Patuxent Research Refuge, Md., thus bringing to a successful conclusion the plans of the Biological Survey for establishing a wildlife research refuge in the East.

During the year 374 miles of refuge boundary lines were surveyed, as well as 160 miles of interior or contiguous lines required by reason of lost and obliterated corners; 47 miles of level lines were surveyed and, to define refuge boundaries, 304 miles were marked. Preliminary to fence construction, 120 miles of boundary lines were staked.

Survey descriptions necessary for title examinations and preparing deeds of conveyance for 894 tracts were completed, covering approximately 251,624 acres, of which 245 tracts of 4,089 acres with irregular boundaries were surveyed preliminary to the preparation of accurate land descriptions. Topographic surveys of 160 acres were made and maps compiled therefrom. Incident to the national wildlife-refuge program, appraisals were made of 5 proposed refuges in as many States, containing a total of 36,500 acres.

RESTORATION OF WILDLIFE HABITAT BY REFUGE DEVELOPMENT

With the completion of major development work, many of the bird refuges recently established were given their first real opportunity to prove their worth, and reports from coast to coast indicate more birds on them than for many years. They are justifying the belief that they will aid materially in alleviating the serious condition of the Nation's wildlife.

Development is only beginning on some of the refuges, but on others it has reached the stage of making adjustments and repairs to refuge structures and of biological reconditioning. As in previous years, assistance was given by the C. C. C., W. P. A., and N. Y. A.

CIVILIAN CONSERVATION CORPS COOPERATION

WORK ACCOMPLISHMENTS

An average of 32 full-strength C. C. C. camps and 1 side camp was used in construction work on 32 national wildlife refuges in 24 States. Water-impoundment work, which entailed moving millions of cubic yards of earth, and construction of headquarters facilities were in the main a continuation of activities discussed in some detail in previous reports. These are here briefly reviewed, however, to show the purposes, activities, and accomplishments of the C. C. C. in 1,451 camp-months of labor during the 6 years that its facilities have been available for refuge development. The nature and significance of the operations in refuge development were popularly presented in a Bureau contribution to C. C. C. publications entitled "The C. C. C. and Wildlife."

Since the establishment of the C. C. C. in 1933 the Biological Survey has added approximately 7,760,000 acres to the national wildlife refuges. These lands compensate in small part for the millions of acres of habitat that necessarily were lost to wildlife through the plow, the ax, and the drainage ditch, but almost all the units acquired were to some extent lacking in the basic wildlife requirements of water, food, and protective cover. Forty-four of the larger and more important refuges have been, or are now being, developed and improved almost exclusively by the C. C. C.

Mentioning a few of the important details will indicate the type and quantity of the work thus far accomplished. There were 72 large impoundments and diversion dams built and 7,443,416 cubic yards of earth and rock and 238 masonry water-control structures used in the construction of levees, dikes, and jetties to reestablish marshes and impound water. Work preliminary to water impoundment included the excavation of 2,566,203 cubic yards of earth and rock from canals and ditches, as well as the clearing and cleaning of 3,422,675 square yards of water channels and 4,852 acres in reservoir, lake, and pond sites. Deficiencies in vegetation were overcome by planting immense quantities of aquatics for waterfowl, numerous shrubs and trees for upland game, and grasses for soil binding and moisture conservation, and as an erosion-control measure 674 permanent check dams were built. Nesting islands were built for the better protection of waterfowl and shorebirds. Construction work involved the erection of 56 dwellings, 21 overnight cabins, and 195 other buildings, including offices, laboratories, garages, and storage houses, and the building of 477,050 rods of fences, 1,977 miles of patrol trails, 169 foot and vehicle bridges, and fire-protection systems that included 47 lookout towers, 600 miles of telephone lines, and several hundred miles of firebreaks.

SAFETY PROGRAM

The safety of personnel is the most important consideration governing C. C. C. operations. Instruction in the importance of adhering to safe practices has resulted in improving the accident record each year, both with regard to severity and frequency. In 1937 there were 5.82 lost-time accidents per 1,000 enrollees; in 1938, 4.69; and in the current

year, only 2.78. This year, in the 1,061,932 days devoted to project work by the enrollees only 143 lost-time accidents occurred; last year there were 200. Two camps, Tule Lake Camp BF–3, Calif., and Charles Sheldon Camp BF–2, Nev., had no accidents this year, and 5 others had only 1 each.

JOB-TRAINING AND EDUCATIONAL PROGRAMS

The diversity of projects in the refuge-development program provides many opportunities for C. C. C. enrollees to learn the fundamentals of skilled trades. To construct roads, dams, bridges, and small buildings and other structural improvements necessary for efficient and economical refuge management, workers must have or acquire a knowledge of carpentry, concrete work, and operation of equipment. Throughout the 6 years of camp activity, classes in these subjects have been among the most popular of the many available to the enrollees.

On the average 269 C. C. C. employees, or approximately 85 percent of all in the Biological Survey camps, conducted on-the-job training courses, and an average of 247, or approximately 78 percent, gave classroom instruction in 76 subjects after working hours, which aggregated 211,258 hours, or an average of 6,154 per camp. Largely through the instruction given in the classrooms and on the work projects, 395 enrollees obtained private employment during the year.

COOPERATION OF WORKS PROGRESS ADMINISTRATION

The development of refuges by W. P. A. labor was continued. Allotments totaling $1,321,787 were made to the Biological Survey by transfer from the W. P. A., providing 24,655 man-months of employment for persons in need of relief. This money was expended on 84 refuges in 22 States. In addition, Bureau-sponsored State projects were approved providing for the expenditure of $955,738 of Federal W. P. A. funds, which were supplemented by the Biological Survey's contribution of $287,702; these provided 18,669 man-months of employment.

The allocation of these funds enabled the Bureau to continue water and wildlife conservation in connection with national wildlife restoration and provided worth-while projects for the employment of relief personnel. The work performed varied with the geographic position of the refuges but consisted chiefly of ditching and of building dams, dikes, and water-control structures to impound water and create marsh areas; planting aquatic and upland vegetation, shrubs, and trees used by wildlife for food and cover; constructing roads and trails, fire lanes, bridges, nesting islands, and upland-game shelters; and posting and fencing boundaries. In several cases, structures necessary for the proper maintenance and administration of refuges were erected, including residences for refuge managers, overnight cabins, boathouses, equipment sheds, barns, storage cellars for aquatic seeds and tubers, and lookout towers.

Federal W. P. A. funds totaling $93,399 were received and supplemented by the Biological Survey's contribution of $41,871 for employing statistical and clerical help to assist in bringing to date the work in the Washington office and in land-acquisition offices in Denver, Colo., and Des Moines, Iowa. About 1,250 man-months of employment were thus provided.

CORRELATION OF DRAINAGE ACTIVITIES WITH WILDLIFE INTERESTS

With the initiation a few years ago of a Federal program to aid unemployment, drainage became an eligible type of project throughout the country. The result of many ill-advised projects was unwarranted destruction of wildlife habitat by the alteration of natural water levels beyond the limits most of the desirable plant and animal forms can tolerate, in many instances eliminating indigenous plant and animal forms and permitting invasion of species that rapidly displaced the food plants of waterfowl and other marsh inhabitants.

This unnecessary destruction of wildlife habitat led to many protests by national and local conservation agencies, State conservation commissions, and private individuals against the prosecution of drainage projects in general through the use of Federal funds. These protests resulted in an understanding with the W. P. A. whereby all project applications involving drainage that were submitted to that organization were to be referred to the Biological Survey for review as to their probable effect on wildlife.

Cooperating with the W. P. A., the Biological Survey reviewed and made field inspection of 364 drainage projects (many of which were State- or county-wide in character), involving 3,294 work units. One hundred and fifty-one units that threatened to be unnecessarily detrimental to wildlife were disapproved through the Bureau's recommendations, and 955 units were recommended for partial or conditional approval, with the proviso that the plans be so modified as not to menace wildlife. In many cases, such modification resulted in the creation of new habitat to compensate for the unavoidable destruction of adjacent natural wildlife environment. The remaining 2,188 units, not involving wildlife values, were recommended for unconditional approval.

Of the 364 projects, 206 (1,812 units) were concerned with mosquito control and 158 (1,482 units) with land-utilization drainage. In the mosquito-control projects, wherever practicable, methods of larva reduction through water control and impoundment rather than by mechanical drainage were recommended and carried out in the interests of wildlife conservation.

NATIONAL YOUTH ADMINISTRATION ASSISTANCE

It would be difficult to overestimate the value of the N. Y. A. type of labor to the refuge program, especially in North Dakota. Without this assistance it would be impossible to obtain accurate data on the 68 widely scattered easement refuges on which permanent personnel is not yet maintained. Members of the N. Y. A. for the most part live on or near the refuges on which they work and serve as official observers. Not only do they supply accurate information to the Biological Survey regarding the condition of the refuges, but they also take an active interest in their upkeep and have created a better local understanding of the refuge program. They noted bird populations, recorded species that could be identified, compiled nesting data, made brood counts, and reported instances of predation and damage to structures by rodents or other mammals. They also reported weekly on the water level and weather and on the condition of buildings, dams, ditches, dikes, fences, and signs.

In addition to collecting data, these youths did some of the improvement work, including gathering seeds of desirable plants on areas where abundant to plant on areas where scarce; transplanting and caring for trees, shrubs, and aquatic plants; repairing fences and signs; and keeping ditches, dikes, and channels clear of weeds. They also regularly patrolled the refuges, and during the hunting season they acted as junior game wardens in accordance with a Statewide plan of the North Dakota Game and Fish Department, reporting immediately any law violations observed.

Work by the N. Y. A. on the Tamarac Refuge, Minn., included constructing portable boat docks and other equipment from salvaged lumber; landscaping and tree planting; building and placing 50 bird houses; taking a waterfowl census; making picnic tables, benches, boats, and concrete walks; feeding wildlife in winter; improving lawns and roads; and collecting aquatic seeds. Similar work was done on the Waubay Refuge, S. Dak., and the Nine-Pipe and Pablo Refuges, Mont.

The activities of these youths are valuable not only to the Biological Survey but also to themselves. Since this type of labor was first utilized in North Dakota in January 1937, 214 young men have been assigned to the Bureau for work on easement areas. Some of them have been employed for only a short time, but all have learned about conservation and have developed new interests that will aid them materially in later life.

ENGINEERING WORK ON REFUGES

Operating out of offices at Salt Lake City, Utah; Des Moines, Iowa; and Washington, D. C., employees of the Bureau of Agricultural Engineering supervised engineering construction on 54 refuges, the work being done in most instances by C. C. C. or W. P. A. labor. In addition, detailed plans were prepared for engineering work on numerous projects acquired or to be acquired, including, in cooperation with the Bureau of Reclamation, those for the restoration of Lower Klamath Lake, Oreg.; many topographic surveys were made; contour maps were prepared; and the engineering feasibility of a number of areas proposed for future acquisition as wildlife refuges was investigated.

Among the outstanding engineering works supervised by the Bureau of Agricultural Engineering may be mentioned the completion by the C. C. C. of the Jacks Creek dike on the Bull Island unit of the Cape Romain Refuge, S. C., begun by Army engineers; the creation of 2 pools, aggregating 3,000 acres, on Seney Refuge, Mich.; the construction of water-control works and about 17 miles of dikes on Mud Lake Refuge, Minn.; and the beginning of engineering work on the Lacassine Refuge, La., and the Aransas Refuge, Tex. One of the district engineers inspected and submitted reports on 67 easement refuges improved by W. P. A. labor in North Dakota.

One hydraulic engineer employed by the Biological Survey attended to the filing of water rights as required by various State laws and to protecting water supplies against other claimants. He also conferred with various Federal, State, and private agencies on matters relating to the use of the water on or affecting the refuges.

BIOLOGICAL DEVELOPMENT OF NATIONAL WILDLIFE REFUGES

FOOD AND COVER

Changing conditions on refuges resulting from ecological management are year by year making them more attractive to wildlife. To expedite improvement, plants high in wildlife food-and-cover values were collected and planted on refuges within their natural range. In the development of water areas more than 85,000 pounds of marsh and aquatic seeds and over 365,000 pounds of plant parts were collected on some refuges and distributed to others. Occasionally climatic and other factors combine to make available exceptional seed crops of certain desirable food plants. This year prairie bulrush produced such a crop and, as the water receded from the marginal areas, it was possible by means of a combine to collect 32,000 pounds of the seed, most of which was distributed to refuges in the Northwest.

In developing upland areas, about 2,000,000 trees, shrubs, and vines (many obtained through the cooperation of the Soil Conservation Service and the Forest Service) were planted, and more than 4,000 pounds of seeds of trees, shrubs, and vines were collected. As the Biological Survey maintains only two active nurseries, a large part of this seed was turned over to the Soil Conservation Service and the Forest Service for propagation.

Nearly 5,000 acres of refuge lands were put under cultivation for green forage and for grain production for supplementary feeding. A large part of this acreage was planted on a sharecropping basis, which relieved the refuge personnel of the tasks of cultivation and harvesting and at the same time improved local economic conditions. More than 220,000 pounds of grain were harvested and used in feeding upland game in winter and in providing food for waterfowl where natural foods were depleted.

Many areas in the West were seeded with grasses and other plants to improve range and forage conditions for wildlife, the species most widely used being crested wheatgrass, bromegrass, sweetclover, and alfalfa.

Cover-type maps, which show the natural vegetation, as well as that resulting from management, and indicate changes that will probably take place, were completed for six refuges and advanced for others, to aid in outlining their development.

NESTING AND SHELTER

As most of the forested areas on the national wildlife refuges consist of cut-over timber or second-growth stands, which are essentially lacking in the hollows used by tree-nesting ducks, more than 1,600 nesting boxes were built to resemble natural tree cavities and placed on refuges that are within the breeding range of the wood duck and the goldeneye. A close check revealed that they were being used extensively by these species and that some had been appropriated by raccoons, squirrels, and opossums.

Construction of nesting islands was continued on the waterfowl-breeding refuges, and 175 were completed. They greatly increase the available waterfowl nesting sites and, being islands, are practically free from predators. On the Malheur Refuge, Oreg., large numbers

of Canada geese and Forster's terns nested on them, and on 1 small island 171 pelican, 14 cormorant, and more than 100 gull nests were located.

The upland game-bird shelters previously constructed on refuges were found extremely valuable in maintaining game-bird concentrations during periods of severe weather, and this year 150 were added. Feed hoppers are maintained in conjunction with many of them in areas where deep snows tend to cover up natural foods.

MAINTENANCE AND OPERATION OF NATIONAL WILDLIFE REFUGES

The national wildlife refuges under the jurisdiction of the Biological Survey, with an aggregate acreage of 13,530,160, now number 260. Of these, 16 (4,094,202 acres) are in Alaska, Hawaii, and Puerto Rico. In addition 14 smaller areas (9,791 acres) are maintained for wildlife experimental and administrative purposes, on which wildlife is also protected. The nature and extent of the 260 refuges are shown in table 4.

TABLE 4.—*Nature and extent of national wildlife refuges administered by the Bureau of Biological Survey*

Character	Number	Acres
For migratory waterfowl (including easement refuges)	139	1,613,632
For other migratory birds	63	951,812
For wildlife in general (birds, mammals, and other classes)	17	4,298,128
For nongame birds chiefly	29	106,712
For big-game species	12	6,559,876
Total	260	13,530,160

The work of maintaining these refuges has increased with the establishment of new units and the completion of development of many of the older ones. Additional personnel, both permanent and temporary, was employed for general administration; for protection against trespass, vandalism, and fire; for enforcement of laws and regulations; for repair and maintenance of buildings, water-control structures, fences, towers, telephone lines, and other physical equipment; and for supervision of grazing, haying, and other farming operations; disposal of surplus big game: and public recreation.

The laws and regulations for the administration of national wildlife refuges were published in Service and Regulatory Announcement B. S. 90, copies of which may be obtained upon application to the Biological Survey. Special regulations were issued from time to time as required.

NEW REFUGES

BIRD REFUGES

The transfer to the Biological Survey of eight former Resettlement projects added about 300,000 acres to the national wildlife refuge system. One tract of about 5,500 acres was added to the Moosehorn Refuge, Maine, established primarily for the protection of woodcocks; and another of about 22,000 acres, to the St. Marks Refuge, Fla., a wintering refuge for thousands of wild geese and

for many species of ducks. The other six were established as new refuges, as follows:

Piedmont Wildlife Refuge, Ga. (about 58,400 acres), by Executive order of January 18, 1939, chiefly for the protection of bobwhite quails and wild turkeys, but also as a wildlife-demonstration area.

Kentucky Woodlands Wildlife Refuge, Ky. (48,759 acres), by Executive order of August 30, 1938, as a sanctuary for deer, turkeys, quails, waterfowl, and other wildlife.

Noxubee Wildlife Refuge, Miss. (about 40,000 acres), Executive order pending, to protect wild turkeys, raccoons, minks, muskrats, beavers, and other wildlife, and also to be a demonstration area and a station for wildlife research.

Carolina Sandhills Wildlife Refuge, S. C. (50,000 acres), by Executive order of March 17, 1939, primarily to protect quails and wild turkeys.

Little Pend Oreille Wildlife Refuge, Wash. (about 56,600 acres), by Executive order of May 2, 1939, as a sanctuary for Pend Oreille deer (probably the largest species of North American white-tailed deer), three kinds of grouse (ruffed, blue, and Franklin's), and other wildlife.

Necedah Migratory Waterfowl Refuge, Wis. (40,500 acres), by Executive order of March 14, 1939, as a refuge for ducks, geese, sandhill cranes, pinnated and sharp-tailed grouse, deer, and other wildlife.

Other important bird refuges established by Executive order included Wheeler Migratory Waterfowl Refuge, 41,800 acres, on the Wheeler Reservoir of the Tennessee Valley Authority, Ala.; Ruby Lake Migratory Waterfowl Refuge, Nev., 35,712 acres; Montezuma Migratory Bird Refuge, N. Y., 6,232 acres; and Great White Heron Refuge, Fla., 1,000 acres of land, including most of the remaining habitat of the now rare great white heron.

BIG-GAME PRESERVES AND RANGES

Two new big-game ranges were established, both in Arizona—the Cabeza Prieta Game Range of 860,000 acres, and the Kofa Game Refuge of 660,000 acres—which are being administered in cooperation with the Grazing Service of the Department of the Interior. They were established primarily to protect the Gaillard bighorn sheep, but other species also receive protection, among them the antelope, peccary, mule deer, and Gambel's quail. Negotiations are pending with the Mexican Government for the establishment of an extensive area south of the Cabeza Prieta Game Range for the protection of bighorn sheep, thus making the project international in character.

On the Kofa Game Range is protected also the fan palm (*Washingtonia arizonica*), which occurs over an area of about 80 acres in one of the most rugged sections of the Kofa Mountains and is not found elsewhere in the world. It grows in deep canyons in sand accumulated in the pot holes worn by waterfalls, and attains a height of 10 to 30 feet.

CONDITIONS ON BIRD REFUGES

INCREASED USE BY BIRDS

References to conditions on a few of the more than 200 bird refuges will indicate the increasing value of the national system for

wildlife conservation and restoration. Various refuges shared in the developmental work already discussed and were thus made increasingly attractive to species for which established. The large increases in the number of birds using some of the refuges may be attributed chiefly to greater stabilization of water levels, improvement of habitat as a result of planting operations and restricted or prohibited grazing, control of predators, and more adequate protection.

Swan Lake Refuge, Mo.—Ducks stopped during the fall migration in larger number than for many years, and thousands of mallards, pintails, teals, baldpates, gadwalls, scaups, and ring-necked ducks concentrated on the refuge, many remaining until January 15.

Waubay Refuge, S. Dak.—In addition to at least 100,000 ducks, a flock of whistling swans and hundreds of geese, mostly white-fronted and Canada, but also several large flocks of blue and snow geese, stopped on this refuge during the fall migration, the first time since the refuge was established that the latter two species of geese have stopped in any numbers in fall and that the swans have appeared.

Valentine Refuge, Nebr.—The fall flight of the sandhill cranes in the vicinity of this refuge was the largest in years, and for the first time a few alighted—usually they fly high and pass over without stopping. The flight of Franklin's gulls also was exceptionally large, and it was estimated that on 1 day in October there were about 30,000 on 2 of the lakes.

Sacramento Refuge, Calif.—During the latter part of November, 1,150,000 pintails, 50,000 mallards, and numerous other waterfowl, including 5 species of geese, were on this refuge. At least three times as many mallards nested in 1939 as in 1938, and there was a large increase in the number of nesting black-necked stilts. A few shovelers and Forster's terns bred for the first time.

Bitter Lakes Refuge, N. Mex.—Among the 300,000 wintering waterfowl, mallards were the most numerous, followed by pintails, baldpates, shovelers, and gadwalls. In the latter part of January, there were at least three times as many waterfowl on the refuge as in the corresponding period in 1938.

Bombay Hook Refuge, Del.—Willets, which nested on the refuge for the first time in 1938, bred again this year—39 pairs—and the number of nesting shovelers increased to 18 pairs. The 1 brood of coots raised provided the southernmost nesting record of this species on the east coast. A ring-necked duck was seen in the spring, an American goldeneye remained from December 9 to March 6, and a pair of gadwalls nested and reared its brood in the tidal salt marsh in the summer of 1939—3 new records for the refuge. On April 13 a black vulture was identified, one of the few records of this bird in the State.

Nine-Pipe, Pablo, and Pishkun Refuges, Mont.—For the first time in many years willets stopped in the fall on these three refuges, marbled godwits on Nine-Pipe, sharp-tailed grouse on Pishkun, and upland plovers on Pablo. During the 1939 spring migration, Holboell's and pied-billed grebes and ring-necked ducks occurred for the first time on Nine-Pipe and Pablo, white-fronted geese on Nine-Pipe, and wood ducks on Pishkun.

Lower Souris Refuge, N. Dak.—Geese, mostly blue and snow, but also a few Hutchins', Canada, and white-fronted, use this refuge in

increasing numbers each year. During the spring flight at least 15,000 stopped, as compared with 2,000 in 1938. It was estimated that 67,000 ducks were on the refuge in May, as compared with 26,060 the previous year. Redheads and canvasbacks showed outstanding gains.

Des Lacs Refuge, N. Dak.—The number of breeding ducks increased from 5,000 in 1938 to 21,000 this year, and a large hatch was expected. Increases were also noted in western, eared, and pied-billed grebes, coots, rails, bitterns, and black terns. Species seen on the refuge for the first time included the European wigeon, western harlequin duck, and surf scoter. For the first time since the refuge was established, all but one of its water units were filled to capacity.

Tule Lake Refuge, Calif.—In January, when the annual waterfowl census was taken, there were 20,533 ducks, 3,233 geese, and 366 whistling swans, a total of 24,132 waterfowl, on this refuge, more than twice the estimated number for the corresponding period in 1938. The number of waterfowl present during both spring and fall migrations showed a marked increase, canvasbacks in particular.

Sand Lake Refuge, S. Dak.—More than 20,000 nests of Franklin's gull were found, as compared with 6,100 in 1938 and about 6,000 in 1937, the first year this species nested on the refuge. Ruddy ducks and redheads also showed substantial increases over previous years.

Malheur Refuge, Oreg.—The number of waterfowl has been steadily increasing, and it was estimated that in the fall there were a million water birds on the refuge. The annual census in January 1939 revealed almost 12,000 wintering ducks, a vastly increased number over 1938.

Cape Romain Refuge, S. C.—The number of lesser scaups wintering on this waterfowl refuge increased from 5,000 in 1938 to 15,000 this year. Other waterfowl remained in about the same numbers as in previous years or showed a slight decrease. More birds were noted during the hunting season than at any other time, more than 80,000 having been counted.

Bear River Refuge, Utah.—More waterfowl were on the Bear River marshes during the fall migration than in any year since the establishment of the refuge; it was estimated that there were at least 2,000,000 ducks at the peak of the migration.

Lacassine Refuge, La.—On this migratory-waterfowl refuge, which has been under administration for 1 year, the January waterfowl census showed more than 50,000 wintering ducks and thousands of other birds. During migration, geese, pied-billed grebes, lesser scaup ducks, black-necked stilts, Wilson's snipes, and sandpipers visited the refuge. A large number of nesting herons began laying eggs on April 1, and the young birds were completely feathered and nearly grown by June 13.

EASEMENT REFUGES

Only 3 new easement refuges were added, all in South Dakota, namely, the Lake Arconge, 240 acres; Eagle Creek, 1,201 acres; and Quinn Lake, 480 acres. Executive orders establishing 40 North Dakota easement refuges were issued. There are now 81 easement refuges, totaling 135,378 acres, of which 68 (109,924 acres) are in North Dakota (3 North Dakota projects were dropped or combined

with others); 8 (22,931 acres) in Montana; and 5 (2,523 acres) in South Dakota. In South Dakota, easements were also obtained covering important additions to 2 existing refuges—the Lake Andes and Lacreek.

In the spring all the North Dakota easement refuges received a good supply of water: the impoundments on 33 reached spillway level, 12 were three-fourths full, 11 were at the halfway mark, 8 had enough water to take care of the birds hatched, and only 4 had insufficient water. All are in better condition than ever before. The Montana refuges that were near enough completion to impound water also received a plentiful supply.

During the spring migration, outstanding concentrations occurred on several of the North Dakota refuges. It was estimated that there were at least 500,000 geese in the vicinity of Lac Aux Mortes, Snyder, Brumba, and Rock Lake Refuges, near Devils Lake, surpassing in numbers the goose flight of 1938, reported the largest for many years. The Ardoch Lake Refuge also had a large concentration of geese, variously estimated at 30,000 to 50,000. Lakes Tewaukan, Ardoch, and Elsie were the nightly resting places for huge flocks of Franklin's gulls during the fall migration, the Lake Tewaukan nightly concentration totaling from 250,000 to 750,000 for almost a month. In October about 10,000 pelicans concentrated on the Dakota Lake Refuge. There was a small decline in the number of ducks nesting on the easement refuges and also in the number stopping during spring migration. The Chase Lake Refuge had about 5,000 breeding ring-billed and California gulls, and the Long Lake Refuge a large colony of Franklin's gulls, estimated at 20,000 nests.

Large numbers of waterfowl and shorebirds used the Lake Thidadeau, Black Coulee, and Hewitt Lake Refuges, Mont., for feeding and resting, and several thousand nested on them. Thousands of ducks, coots, grebes, gulls, and shorebirds also bred on the small Greedmans Coulee Refuge, which was completed only this year. The other Montana projects either are still under construction or were finished too late in the season to be much used.

In South Dakota only the Lake Andes Refuge was near enough completion to attract many birds, but thousands of waterfowl and shorebirds nested or fed there during migration.

Since there was little acquisition activity on easement refuges, attention was directed principally to completing construction and improvement work and to biological reconditioning. During the year the W. P. A. funds expended on the North Dakota easement refuges totaled $114,060, providing about 1,800 man-months of employment; on the Montana refuges, about $98,700, providing 1,853 man-months; and in South Dakota, about $32,500. The major operations included the building of control works; constructing and graveling roads; placing additional riprap to protect various structures; building nesting islands and bridges; drilling wells; repairing dams, ditches, spillways, fences, and signs; planting trees and aquatics; and constructing recreational facilities.

CONDITIONS ON GAME PRESERVES

The numbers of big-game animals on the Bureau's fenced preserves are given in table 5.

TABLE 5.—*Animals on fenced big-game preserves maintained by the Bureau of Biological Survey (estimated)*

ANIMALS AS OF JUNE 30, 1939

Preserve	Buffalo	Elk	Antelope	Bighorn sheep	Deer		Texas longhorn	Total
					Whitetailed	Mule		
National Bison Range, Mont.	428	40	.....	54	47	161	.....	730
Fort Niobrara Game Preserve, Nebr.	156	39	.....	.....	7	5	18	225
Sullys Hill Game Preserve, N. Dak.	22	31	.....	.....	15	.....	.....	68
Wichita Mountains Wildlife Refuge, Okla.	420	202	15	.....	759	.....	149	1,545
Total	1,026	312	15	54	828	166	167	2,568
YOUNG BORN IN CALENDAR YEAR 1938								
National Bison Range, Mont.	69	12	.....	13	5	52	.....	151
Fort Niobrara Game Preserve, Nebr.	31	11	.....	.....	.....	.....	4	46
Sullys Hill Game Preserve, N. Dak.	7	8	.....	.....	4	.....	.....	19
Wichita Mountains Wildlife Refuge, Okla.	74	25	6	.....	100	.....	22	227
Total	181	56	6	13	109	52	26	443

Charles Sheldon Refuge, Nev.—Following ample snow and rain on this antelope refuge and range, grass and forage made an exceptionally fine growth in the summer of 1938, but as there was not much precipitation during the following winter, the grass started drying early in May. No stock is permitted to graze on the winter range of the antelope, however, so there will be ample winter forage for all the wildlife there. The antelope returned to their summer range in fine condition. At the beginning of the year, 2,500 were estimated to be on the refuge, but when winter storms set in, driving the animals to their winter range, the number increased to about 5,000. Mule deer, definitely on the increase, were estimated at 2,000 at least, and the band of wild horses at between 250 and 300. An increase in the number of ducks and geese also was noted.

Fort Niobrara Preserve, Nebr.—A good hay crop was in prospect on this preserve, and though part of that harvested by sharecroppers last fall was used for the winter feeding of buffalo, much still remains for next winter. In addition to the big-game animals listed in table 5, numerous birds use this preserve, and this year prairie chickens, pheasants, quails, and grouse were seen and 500 ducks remained all winter. The small trees and shrubs planted around the headquarters building attracted many insectivorous birds, also.

Hart Mountain Refuge, Oreg.—Plentiful rainfall early in 1938 resulted in greatly improved range conditions on this refuge, but spring precipitation was deficient in 1939. Big-game counts showed 2,000 antelopes on the refuge and about 1,400 on adjacent areas and, in the latter part of December, 2,011 mule deer. A definite increase in the number of sage grouse was shown by the fact that on an area where 47 were counted in 1937, there were 440 this year. A slight increase in Hungarian partridges also was observed. As the year closed Miscellaneous Publication 355, describing this refuge, was in press.

Desert Game Range, Nev.—Despite little spring rainfall, this game range, which has been greatly overgrazed in the past, is improving,

owing to the curtailment of many grazing permits. It was estimated that 300 bighorn sheep were on the range at the close of the year, about 23 percent of which were lambs.

Sullys Hill Preserve, N. Dak.—About 12 acres of trees were cut by W. P. A. labor last winter on this preserve to provide a growth of sprouts and shrubs for deer and elk browsing, 7 acres of which were fenced to keep animals out and allow the plants to get a few years' growth. A good stand of grass provided excellent grazing for the animals. The refuge is much used by birds also. About 2,000 ducks stopped on the lake in the fall and 1,000 in the spring, but few nested, as the lake is surrounded by trees and does not provide good nesting cover.

Wichita Mountains Refuge, Okla.—Lake levels were too low this year for recreational purposes, but there was ample water for the big game and other wildlife. Approximately 450 wild turkeys were counted during the winter. Bobwhites and doves were present in fair numbers, the former appearing to have become reestablished after being rare for many years, but prairie chickens were scarce, 18 being the largest number counted at any one time.

Elk Refuge, Wyo.—Owing to considerable rainfall in Jackson Hole last year and a favorable growing season, natural forage was excellent on the pasture and range lands of the refuge and elk herds fared well on it until the latter part of February, when a 33-day feeding period began, during which about 18,665 bales, or 849 tons, of hay were fed and 143 tons of loose hay. A total of 37,100 bales was harvested in the summer and early fall of 1938, and the crop on 780 acres was left standing as elk pasturage. About 8,000 elk were fed on the refuge during the winter, 1,800 more than in the previous year, and about 1,000 wintered in the nearby foothills and along the Gros Ventre River. Though more elk were on the refuge, the number in the Jackson Hole herd remained about the same as in the spring of 1938, when 17,370 were counted. The mule deer seen numbered 32, and the moose 7. More waterfowl were present during the fall migration than for many years, the increase in Canada geese being at least 50 percent. Nesting species included the sandhill crane and several ducks. Three of the four trumpeter swans that were transferred to the refuge from the Red Rock Lakes Refuge, Mont., last winter were seen daily less than a mile from headquarters.

National Bison Range, Mont.—Forage conditions on this range were such that winter feeding of the buffaloes was not necessary, though some hay was put out for the deer during periods of heavy snow. Late in February and early in March approximately 3½ acres each of blue grama and little bluestem grass and 43 acres of crested wheatgrass were sown as an experiment in range revegetation. In cooperation with the University Forestry School at Missoula, test plots of mountain brome, sand dropseed, mountain rice, and native bunch grass also were planted. Ducks and geese were plentiful on the refuge both in spring and fall, and during the local hunting season hundreds of pheasants came to the refuge and many remained.

ECONOMIC USES OF REFUGES

Permits to the number of 730 were issued for numerous economic and special uses of wildlife-refuge lands, chief of which were hay

and timber cutting and livestock grazing. On about 29,475 acres of refuge lands 157 permits were issued for cutting 11,190 tons of various kinds of hay. Grazing permits numbered 117, authorizing approximately 117,350 animal-months' use by about 17,150 cattle, 12,250 sheep, 300 horses, and 75 hogs, chiefly on the following refuges: Valentine, Nebr.; Aransas, Tex.; Malheur, Oreg.; Bosque del Apache, N. Mex.; and Hart Mountain, Oreg., which provided grazing. Although only about 1,800 cords of timber were cut, this use provided much-needed wood for 164 permittees, most of whom were individuals living in the immediate vicinity and requiring fuel wood for personal use only.

Another major economic use of the refuges was the cooperative farming of approximately 32,350 acres. For this purpose 172 permits were issued to persons who agreed to raise various farm crops and hay for the big-game animals on the refuges.

For miscellaneous uses, 120 permits were issued, authorizing ice cutting; erection, maintenance, and use of buildings and of telephone and power lines; placing stands of bees; picking fruit in orchards; and opening and maintaining stock driveways or lanes for watering cattle.

To keep the herds of big game at a level where they will not overgraze their ranges, it is necessary each year to dispose of surplus animals. Whenever possible, these are donated to city and State parks and zoos for exhibition purposes; but some are sold or given to various Federal, State, and private agencies for butchering. This year 55 buffaloes, 4 deer, and 29 elk were disposed of. Of the buffaloes, 33 were sold for butchering, 13 were donated for exhibition purposes, and 9 were given to Indian agencies for food. The 4 deer, accidentally killed, were given to a charity organization. Of the 29 elk, 18 were donated for exhibition purposes, 6 were sold, 2, accidentally killed, were given to charity, and 3 were given to an Indian agency.

The total revenue received from the sale of surplus big-game animals and other refuge products and for the use of refuge lands was $45,213.52. In accordance with the law, 25 percent of the total is turned over to the counties in which the refuges are situated and the remainder is deposited in the Federal Treasury.

RECREATIONAL USES

In addition to their agency in increasing the wildlife population, the refuges have other public values. Many of them provide the only recreational facilities within a radius of many miles, and where it has been found that controlled use for public enjoyment will not unduly interfere with the wildlife, fishing, swimming, boating, camping, picnicking, sightseeing, and other recreational uses are permitted to some extent. Hunting during the open season is permitted on specified parts of only six refuges—Tule Lake, Calif.; Bear River, Utah; Red Rock Lakes, Mont.; Lake Bowdoin, Mont.; Upper Mississippi, Iowa, Ill., Minn., and Wis.; and Mattamuskeet, N. C.

Orders designating areas on which fishing is permitted were issued for the following refuges: Savannah River, Ga. and S. C.; Tamarac and Rice Lake, Minn.; Big Lake, Ark.; Kentucky Woodlands, Ky.; Elk Refuge, Wyo.; Seney, Mich.; Lower Souris, N. Dak.; and Wich-

ita Mountains, Okla. On the Okefenokee Refuge, Ga., under permits issued for 5,319 man-days of fishing, 47,223 fishes were taken. In 4 months, 10,138 fishermen took 67,239 fishes from the waters of the Chautauqua Refuge, Ill. Permits were issued to 693 persons in 1 month to fish on the Mattamuskeet Refuge, N. C. On the opening day of the fishing season, 8,000 persons fished on the Wichita Mountains Refuge, Okla., which supplies some of the best fishing in that State.

Picnic facilities, consisting usually of shelters, tables and benches, outdoor ovens, and toilets, have been constructed on many refuges. Thousands of persons annually visit some of the refuges to view the wildlife, and this year exhibition herds of buffalo, elk, and deer on small Sullys Hill Game Preserve, N. Dak., attracted 22,383 visitors.

WILDLIFE-CONSERVATION LAWS ADMINISTERED

The principal Federal statutes administered by the Biological Survey for the conservation and restoration of wildlife are (1) the Lacey Act of 1900, as amended June 15, 1935, and June 19, 1939, regulating shipments in interstate and foreign commerce of wild animals, their dead bodies, or parts thereof, and the importation of live birds and mammals from foreign countries; (2) the Migratory Bird Treaty Act of 1918, protecting birds that migrate between the United States and Canada, as amended June 20, 1936, to extend its provisions to the treaty concluded March 15, 1937, protecting birds that migrate between the United States and Mexico, and regulating the movement of game mammals and parts thereof between the two countries; (3) the Migratory Bird Conservation Act of 1929, authorizing the establishment of bird refuges; (4) the Migratory Bird Hunting Stamp Act of 1934, as amended June 15, 1935, to aid in refuge establishment; (5) the Federal Aid to Wildlife Restoration Act of 1937; (6) a law (sec. 84, Criminal Code) protecting wildlife and property on national wildlife refuges; and (7), through the Alaska Game Commission, the Alaska Game Law of 1925, as amended June 25, 1938.

REGULATORY ACTION

The Migratory Bird Treaty Act regulations were amended in 1938 to provide an open season of 45 consecutive shooting days on migratory waterfowl, coot, and Wilson's snipe, in each of 3 zones, beginning in the northern zone on October 1, in the intermediate zone on October 15, and in the southern zone on November 15. Full protection was continued on the wood duck, Ross' goose, and swans throughout the country, and on the snow goose and brant in States bordering on the Atlantic Ocean. A limit of 3 of any one or 3 in the aggregate, of canvasbacks, redheads, buffleheads, and ruddy ducks was permitted in the daily bag limit of 10 ducks of all kinds.

The restrictions on taking waterfowl by means of bait or by the use of live decoys, and the three-shell limit on repeating shotguns, remained in effect. The hours for shooting waterfowl and coots were from 7 a. m. to 4 p. m.; for taking Wilson's snipes, rails, and gallinules (other than coots), woodcocks, mourning doves, white-winged doves, and band-tailed pigeons, from 7 a. m. to sunset. The posses-

sion limit was raised to not more than 2 days' bag limits of ducks and geese, including brants, but remained the same as a daily bag limit on all other migratory game birds, as follows: Rails and gallinules (except soras and coots), 15 in the aggregate of all kinds; soras, 15; coots, 25; Wilson's snipes, 15; woodcocks, 4; and mourning doves and white-winged doves, 15 in the aggregate of both kinds. Band-tailed pigeons remained in their previous status, with a maximum bag of 10. The regulation governing interstate shipment of migratory game birds was amended to permit shipping the possession limit in 1 calendar week out of the State where taken or from Canada or Mexico into the United States.

The regulations for 1938 were published in Service and Regulatory Announcement B. S. 92; the open-season dates and other information regarding hunting, in poster form (61–Bi). Other publications relating to conservation laws included a mimeographed abstract of State fur laws affecting trapping seasons, possession, and the sale and shipment of pelts (Leaflet BS–118) and Miscellaneous Publication 329, the annual directory of Federal, State, and Canadian game-protection officials. Many press and radio statements on wildlife-conservation subjects also were released for educational purposes and to advise the public of the results of law enforcement as well as of changes in the regulations. Amendments to the regulations under the Alaska Game Law were published in Circular 17 of the Alaska Game Commission.

Representatives of the State game departments again met with officials of the Bureau to discuss conditions affecting the conservation and hunting of migratory game birds and their pursuit by hunters. Their recommendations were a great aid in drafting the hunting regulations for the 1939 season.[3]

WORK OF GAME-MANAGEMENT AGENTS

Working under central direction and the general supervision of regional directors, 42 game-management agents and 13 deputy agents gathered information in cooperation with State officers and deputy game wardens, supplemented evidence, or themselves furnished all the evidence in 2,560 cases of game-law violation prosecuted in State and Federal courts, resulting in 2,444 convictions. In educational work to further game protection, the agents conducted programs by radio and motion pictures, spoke before schools, civic associations, and sportsmen's clubs, and issued statements through the press. They also worked with farm groups to control birds that were damaging crops. Each spring and summer the agents have inspected nesting areas in their districts to determine the relative abundance of wild fowl. They are looked to by State conservation agencies, sportsmen, nature students, and citizens interested in wildlife for leadership in the enforcement of laws for wildlife conservation. The varied lines of work and responsibilities of Federal personnel engaged in game-law enforcement were set forth in detail in a leaflet (BS–135) issued in May.

[3] Regulations for 1939 were adopted by the Secretary of the Interior on August 3, 1939, and were approved and proclaimed by the President on August 11, 1939 (4 F. R. 3621 DI).

APPREHENSION OF VIOLATORS

The enforcement activities of the game-management agents are exemplified in the following apprehensions:

In Ohio, 9 persons apprehended were convicted in Federal court for violating and conspiring to violate the Migratory Bird Treaty Act by hunting wild ducks by aid of feed and live decoys. One was fined $1,500, received a sentence of 1 year and a day in jail (suspended upon payment of fine), and placed on probation for 5 years. The others paid fines aggregating $525. In addition, 4 were given suspended jail sentences of 6 months each and placed on probation for 5 years and 2 each were placed on probation for 1 year.

In Kentucky, 37 persons accused of hunting mourning doves over baited ground were convicted in Federal court, and each was fined $50 and $20 costs, but payment of the fine was suspended in 3 cases.

In Virginia, a defendant charged with killing 2 American egrets was fined $250 in Federal court.

In Michigan, a person accused of hunting coots and wild ducks from a motorboat was sentenced to serve 6 months at the Federal Detention Farm at Milan.

In Arizona, of 5 persons apprehended in possession of 207 white-winged doves and 43 mourning doves, 1 was sentenced to pay a fine of $50 and to serve 60 days in jail, 2 to pay fines of $100 each, and 2 to pay fines of $50 each.

In Maryland, 2 persons arrested for killing mourning doves by aid of feed were fined $100 and costs of $31 each.

In Louisiana, for selling wild ducks, 2 defendants were each sentenced to 60 days in jail; for hunting ducks over live decoys, 1 was sentenced to 30 days and 1 to 60 days in jail; for hunting ducks after 4 p. m., with an unplugged gun, and for threatening to shoot an agent of the Survey and a State conservation agent, 2 each received a jail sentence of 1 year.

In a drive to break up the commercializing of game in California, 12 persons were apprehended for selling wild ducks and geese. Ten convictions were obtained in Federal court, resulting in fines aggregating $750 and the imposition of jail sentences of 3 months for 2 persons and 4 months for 1.

In Missouri, 2 culprits convicted of possessing and selling finches and buntings as cage birds were fined $60 and $30, respectively.

In Massachusetts, for possessing ducks in closed season and for selling ducks, 2 persons each received a suspended jail sentence of 4 months and were placed on probation for 2 years.

Of the 861 new cases filed in the Federal courts, 620 were disposed of with 504 convictions. That more than 81 percent of the 620 prosecutions resulted in convictions indicates that the agents are not making useless arrests or prosecutions. The same percentage was achieved also in the preceding year.

A summary of the year's prosecutions is given in table 6.

TABLE 6.—*Summary of prosecutions of game-law violations, fiscal year 1939*

Act	Convictions	Fines and costs	Jail sentences
	Number	*Dollars*	*Days*
Migratory Bird Treaty Act	648	20,648.63	2,585
Migratory Bird Conservation Act	15	215.00	300
Migratory Bird Hunting Stamp Act	87	609.42	90
Wildlife Refuge Trespass Act	16	221.00	----------
Upper Mississippi River Wildlife and Fish Refuge Act	11	230.55	----------
Lacey Act	19	1,757.71	210
State prosecutions resulting from Lacey Act investigations	147	5,480.19	----------
State laws, cooperative prosecutions	1,501	42,122.06	1,199
Total	[1] 2,444	71,284.36	4,384

[1] In 116 other cases the defendants were found not guilty or the cases were dismissed, bringing the total cases to 2,560.

UNDERCOVER OPERATIONS

In making appropriations for the protection of migratory birds, Congress authorized the expenditure of not to exceed $10,000 in the discretion of the Secretary for the purpose of obtaining information concerning violations of the Federal game laws. This action opened a new avenue of attack against commercialism in waterfowl. Lateness in promulgating regulations resulted in the expenditure of only $2,393.68 for confidential undercover operations, but the evidence and information acquired were presented in courts against 105 defendants. These were assessed fines of $4,500 and costs of $780.50, with $200 in fines suspended; in addition, sentences of 740 days in jail were imposed; sentences of 90 days in jail were suspended; imposition of sentences was suspended for 3 years in each of 8 cases; and an aggregate of 7 years' probation was imposed in each of 3.

MIGRATORY BIRD TREATY ACT CASES

There was an increase over the preceding year of 192 Migratory Bird Treaty Act cases reported for Federal prosecution; an increase in convictions obtained; and an increase in cases terminated. Fines ranging from $1 to $1,500 and costs aggregating $20,648.63 were imposed in Federal courts; and in 12 cases, fines aggregating $526 were suspended. Jail sentences aggregating 2,585 days were assessed as follows: 5 days, 3 cases; 10 days, 2; 20 days, 1; 30 days, 14; 60 days, 10; 90 days, 4; 120 days, 2; 6 months, 1; 1 year, 2. Suspended jail sentences: 6 months, 4; 1 year and 1 day, 1. Probation terms: 6 months, 5; 1 year, 10; 18 months, 8; 2 years, 11; 3 years, 2; 5 years, 8.

MIGRATORY BIRD CONSERVATION ACT CASES

For violations of the Migratory Bird Conservation Act, 30 new cases were submitted and 4 were pending from the previous year; of these 18 were closed as follows: $5 fine, 1 case; $10 fine, 1; $200 fine, 1; 30 days in jail, 1; 60 days in jail 3; 90 days in jail, 1; 1 day probation, 3; 6 months' probation, 3; 1 year probation, 1; dismissed, 1; closed without prosecution, 2. Cases pending, 16.

MIGRATORY BIRD HUNTING STAMP ACT CASES

New cases submitted for violations of the Migratory Bird Hunting Stamp Act totaled 88; cases pending from the year previous, 45. Of these, 87 were successfully concluded, the fines ranging from $1 to $25, which with costs aggregated $609.42. Sentences were as follows: 30 days in jail, 3 instances; 30 days in jail suspended, 3; 1 year probation, 1. Other cases were disposed of as follows: Dismissed, 12; closed without prosecution, 1; nol-prossed, 1; jury trial, not guilty, 1; grand jury, no true bill, 2. Cases still pending, 30. It is significant of increased law observance that the sales of the $1 migratory-bird hunting stamps increased from $783,039 in 1938 to $1,002,715 in 1939.

WILDLIFE REFUGE TRESPASS ACT CASES

Under the law protecting wildlife and Government property on national wildlife refuges, 11 new cases were reported and 21 were pending from the previous year. Of these, 16 were closed by fines aggregating $221; in 6, defendants were placed on probation for an aggregate of 8 years; 4 were dismissed; and in 1, a jury returned a verdict of not guilty. Cases still pending, 5.

UPPER MISSISSIPPI RIVER REFUGE CASES

Of 8 cases pending from the preceding year and 26 new cases reported for prosecution, 14 were closed as follows: In 11, fines and costs aggregating $230.35, suspended jail sentences of 40 months, and probations of 6 years were imposed; 2 were dismissed; and 1 was closed without prosecution. Cases pending, 20.

LACEY ACT CASES

For illegal interstate shipment of wild animals or parts thereof, 18 new cases were reported for prosecution in Federal courts and 4 were pending from the year previous. The new cases were disposed of as follows: In Tennessee, 10 persons paid fines and costs amounting to $585.21 for transporting 1,222 dead bobwhites from Mississippi; in New Mexico, 1 was fined $500 and sentenced to 90 days in jail for shipping out a beaver pelt; in Wisconsin, 2 were fined $200 and $100 respectively for shipping beaver and other furs to Minnesota; in California, 1 was sentenced to 120 days in jail for shipping beaver pelts to Washington and 1 was fined $250 for shipping elk carcasses from Montana; in Texas, 2 were each fined $25 for receiving parts of deer shipped from New Mexico; and in Michigan, 1 was placed on probation for 3 years for shipment of beaver pelts to Ohio. Of the 4 pending cases, 2 were undisposed of, 1 was dismissed, and 1 resulted in a fine of $50 and costs of $22.50 for purchasing furs illegally shipped from Iowa to Nebraska.

Agents making inspections under this statute at fur-receiving centers in 18 States discovered information relating to possible infractions of State game laws. Invoices relating to 1,816 shipments of pelts were sent to game-protection officials in 35 States, Alaska, and Canada and disclosed 147 law violations that were terminated in State courts by fines and costs aggregating $5,480.19.

OTHER COOPERATION WITH STATES

Evidence regarding 1,501 cases involving violations other than illegal interstate shipment of skins of fur animals was handled in 43 States, where fines and costs aggregated $42,122.06 and jail sentences in 36 cases totaled 1,199 days. Special investigations by State wardens and Biological Survey agents working together broke up many commercial rings operating unlawfully in furs and game. Coordinated patrols were effective in developing a more wholesome respect for, and a more general observance of, conservation laws. Bureau officers participated as instructors in game-warden schools in several States. In some instances the States and the Bureau employed enforcement officers and operated patrol boats jointly. Such cooperation assures increased protection of wildlife.

COURT ACTION ON BAITING CASE

In a case involving the hunting of mourning doves by means of feed, in which the issue was whether averment and proof of knowledge of baiting is necessary to constitute a cognizable offense under the Migratory Bird Treaty Act and the regulations thereunder, Judge John D. Martin, Sr., in the United States Court for the Western District of Tennessee, on June 13 overruled both the demurrer of the defendant and his motion to quash the information, in the following terms:

> Nowhere in the statute, or in the regulations promulgated pursuant thereto, will be found, either in express language or by necessary implication, any requirement of averment or proof of *knowledge* to constitute a punishable violation of the statutory offense charged. * * *
>
> The fact that the penalty provided is within the discretion of the trial judge a fine, or an imprisonment, or both, affords adequate protection to an offender unconscious of law violation against punishment more excessive than would be commensurate with the degree of guilt. Conviction does not necessarily mean imprisonment. No minimum fine is even required. A nominal, or a small fine may be imposed upon a technical violator, innocent of guilty intent. If justice demands it, the conscious law violator, or the repeater, may be imprisoned within the limits of the statute. Congress has not placed an unintentional law violator in unjust jeopardy of arbitrarily fixed punishment, but

has confided to the courts the duty and discretion of making the punishment fit the crime. * * *

The conclusion has been reached that, in the instant case, it is unnecessary for the Government either to aver in the information, or to prove at the trial, that the defendant had knowledge of the unlawful baiting of the hunting ground, in order to render him amenable to punishment for a violation of the statute and the regulations promulgated pursuant thereto by the Secretary of Agriculture.

IMPORTATION AND OTHER PERMITS ISSUED

SPECIES EXCLUDED

The Biological Survey prevented on several occasions attempted importations of common mynas, bullfinches, chaffinches, and greenfinches, the entry of which is prohibited by joint action of the Secretary of Agriculture and the Secretary of the Treasury. No attempts to import mongooses or other prohibited mammals were reported. Since the passage of the Lacey Act on May 25, 1900, pursuant to which the regulations were adopted, no forbidden species of bird or mammal has established a foothold in the United States.

Applications continued to be received for permits to import, usually from Mexico and the Tropics, mockingbirds, grosbeaks, American goldfinches, indigo and painted buntings, and other migratory birds, but all such applications were rejected. On several occasions the Bureau's inspectors intercepted in miscellaneous shipments species of migratory birds that were referred to in applications for permits as canaries or other species of finches that may be lawfully imported. When migratory birds are detected in such cases, they are confiscated and donated to public zoological parks for scientific or educational purposes. By close supervision in this respect, migratory birds of species native to the United States are being excluded from the traffic in imported cage birds.

SPECIES ENTERED UNDER PERMIT

Including 20 at Honolulu, Hawaii, 1,791 permits were issued for the importation of foreign birds and mammals, and 440 importations were inspected.

BIRDS

A total of 252,628 foreign birds were imported into continental United States, as compared with 270,000 last year. They included 121,024 canaries, 2,799 parrots, 87,457 Mexican quails, 14,510 Hungarian partridges, 396 pheasants, and 26,442 miscellaneous birds, decreases being especially notable in canaries and parrots. At Honolulu, 492 foreign birds were entered, as compared with 1,090 last year.

Several large shipments of Hungarian partridges were again brought in from Europe during January and February by authorities in Pennsylvania, although the total number was slightly less than last year, and about 540 individuals were imported from Canada.

By order of August 19, 1938, of the Secretary of the Treasury and the Secretary of Agriculture, the joint regulations of November 21, 1927, and all amendments thereof, governing the importation of bobwhite quails from Mexico were revoked, effective September 1. This

revocation resulted in the elimination of health inspection of quails at the border, a requirement that was found to have survived its necessity, but provision was continued for the issuance of special permits by the Secretary of Agriculture for the importation of such birds, as required by section 241 of the Penal Code. As a consequence, importation permits were issued direct from the Washington office during the past season instead of at Texas ports of entry, but only to applicants or their agents who had previously obtained export permits from the Mexican Government. The latest season prescribed by Mexico for the capture of bobwhite quails extended from December 1, 1938, to March 31, 1939, but the first shipment of these birds did not arrive in the United States until January 10, when 50 were entered. Thereafter in the month, and during February and March, they continued to come in steadily in larger consignments through ports in Texas. The total number imported was 87,457, compared with 79,465 last year, of which 4,594 were entered at Brownsville, 39,346 at Laredo, and 43,517 at Eagle Pass, Tex. Of those entered at Eagle Pass, 2,782 are reported to have died in the warehouses of the importer and, because of poor condition, 269 were liberated. The rest were distributed as follows: Indiana, 21,412; Texas, 21,325; Mississippi, 15,650; Kentucky, 12,571; West Virginia, 3,550; Florida, 3,192; Oklahoma, 1,225; South Carolina, 1,150; North Carolina, 710; Pennsylvania, 490; District of Columbia, 425; New York, 415; Illinois, 350; Delaware, 250; Tennessee, 200; Hawaii, 200; Massachusetts, 186; Missouri, 175; Alabama, 173; Louisiana, 100; and several other States, several small shipments of less than 100 each.

Among the more interesting pheasants imported were 17 of 5 species as follows: 2 Horsfield pheasants (*Gennaeus horsfieldii*), from Italy; 4 Blyth's tragopans (*Tragopan blythii*) and 4 Satyr tragopans (*T. satyra*), from France; and 2 Koklass pheasants (*Pucrasia macrolopha*) and 5 cheer pheasants (*Catreus wallichii*), from India.

The Public Health Service recently materially revised the regulations affecting the importation of birds of the parrot family. A privately owned shipment is now limited to three instead of five parrots, and it must be accompanied by the owner, who is required to certify that the birds have been in his possession for not less than 2 years and that he has no intention of selling, bartering, giving away, or publicly exhibiting them. Commercial shipments of parrots, or shipments of parrots for exhibition in zoological gardens or parks or for scientific study, now require, in addition to a permit from the Secretary, one from the Surgeon General. The period of quarantine, heretofore 15 days, has been extended to 6 months.

Among the more interesting parrots imported were 25 of 10 species as follows: 2 Ceram lories (*Trichoglossus haematod* or *Lorius flavopalliatus*), 1 Australian lorikeet (*Lathamus discolor*), and 2 Rajah cockatoos (*Probosciger aterrimus*), from Java; 1 bare-eyed cockatoo (*Ducorpsius sanguineus*), from the Philippines; 5 king parakeets (*Alisterus scapularis*), 4 pennant parakeets (*Platycercus elegans*), 5 Rosella parakeets (*P. eximius*), and 3 Brown's parakeets (*P. venustus*), from Australia; and 1 hawk parrot (*Deroptyus accipitrinus*) and 1 Finsch's parrot (*Amazona finschi*), from Central America.

Other interesting birds imported were 1 monkey-eating eagle (*Pithecophaga jefferyi*), from the Philippines; 1 yellow-striped spar-

row (*Atlapetes citrinellus*) and 20 rufous ovenbirds (*Furnarius rufus*), from Argentina; 4 Yuca birds (*Notiopsar curaeus*), from Peru; 2 Princess Stephanie birds of paradise (*Astrapia stephaniae*), 1 blue Prince Rudolph bird of paradise (*Paradisea rudolphi*), 1 Cape York riflebird (*Craspedophoro magnifica alberti*), and 3 six-plumed birds of paradise (*Parotia sefilata*), from New Guinea; 3 concave-crested hornbills (*Rhytidoceros plicatus*), from Singapore; 3 tigrine doves (*Spilopelia tigrina*), 3 Javan jungle fowl (*Gallus gallus bankiva*), 1 Javan owl (*Huhua orientalis sumatrana*), and 2 Javan coucals (*Centropus bengalensis javanicus*), from Java and Sumatra; 2 black-throated coachwhip birds (*Psophodes nigrogularis*), 1 spotted bower bird (*Chlamydera maculata*), 4 rifle birds (*Ptiloris victoriae*), 1 kagu (*Rhinochetus jubatus*), and 1 laughing jackass, or brown kingfisher (*Dacelo gigas*), from Australia; 2 Chinese mynas (*Sturnia turdiformis*) and 1 black-throated jay (*Garrulus lanceolatus*), from India; 3 Brewster's boobies (*Sula leucogastra brewsteri*), from Central America; 3 black-faced cardinals (*Paroaria nigrigenis*), from the West Indies; 1 restless flycatcher (*Seisura inquieta*), 2 bower birds (*Ailuroedus melanoti*), 1 giant heron (*Ardea goliath*), 2 sikkim red-headed laughing thrushes (*Trochalopteron erythrocephalum nigrimentum*), and 2 Argentine pygmy rails (*Laterallus leucopyrrhus*), in shipments from Germany.

A rather definite but as yet restricted trend toward the practice of falconry in a few sections of the country was indicated in some degree by the importation of gyrfalcons from Greenland and goshawks from Canada.

MAMMALS

Importations of black bear cubs from Canada were greater than for several years. The total number brought in was 137, compared with 87 last year. Importations of primates included 2 rare tarsiers (*Tarsius spectrum*), from the Philippines; several species of anthropoid apes and larger monkeys, from Africa; gibbons, macaques, and orangutans, from Singapore; and as usual a great variety of the smaller monkeys, including marmosets, capuchins, and spider monkeys, from Central America and South America. The total number of rhesus monkeys imported was 12,536, as compared with 15,851 last year.

Among the more interesting mammals imported were 14 of 10 species as follows: 1 pangolin (*Paramanis javanica*), from Sumatra, said to be the first of these animals ever brought alive to the United States; 1 "tiglon" (*Felis*), the offspring of a Siberian tiger and African lioness, in a shipment from Germany for the Central Park Zoo in New York City; 1 giant flying squirrel (*Eupetaurus cinereus*), also in a shipment from Germany; 1 cuscus (*Phalanger* sp.), from New Guinea; 1 giant panda (*Ailuropoda melanoleucus*), from China; 1 eyra (*Felis yagouaroundi*), and 1 Paraguayan opossum (*Didelphis paraguayensis*), from Brazil; 2 viscachas (*Lagostomus trichodactylus*), and 3 South American foxes (*Dusicyon* sp.), from Argentina; and 2 Tasmanian devils (*Sarcophilus harrisii*), in a shipment from the Netherlands.

PERMITS UNDER THE MIGRATORY BIRD TREATY ACT

FOR SCIENTIFIC PURPOSES

To take migratory birds or their eggs for scientific purposes, 341 permits (general or under specific limitations) were issued, 83 were revoked, and 1,715 were outstanding at the close of the year. To possess migratory birds or their eggs, lawfully acquired for scientific purposes, 70 permits (under limitations) were issued and 472 were outstanding at the close of the year. For possession of 1 or a few specimens of birds found dead, where the finder was not directly or indirectly implicated in the killing, 198 permits were issued. For banding migratory birds, permits were issued to 167 cooperators of the Bureau. For taking birds and mammals in Alaska for scientific purposes, 32 permits were issued, principally to scientific and educational institutions.

FOR PROPAGATION

Permits to take migratory waterfowl for propagation were issued to 44 persons, the permits prescribing the species and the number of individuals of each and the time during which they might be taken. To possess migratory waterfowl, lawfully acquired, for propagating purposes, 340 permits were issued. Because of failure of permittees to render the annual reports required by the regulations or to surrender permits when operations thereunder had been discontinued, 640 propagating permits were recalled, cancelled, or revoked. At the close of the year, 3,500 propagating permits were outstanding.

Reports submitted by permittees disclose that 3,493 wild geese and 62,218 wild ducks were reared in captivity, of which 56,352 were mallards, 3,509 black ducks, 863 wood ducks, and the remainder principally teals, ringnecks, wigeons, pintails, and redheads. Sales of propagated migratory waterfowl for food purposes included 13,073 ducks and 502 geese, and for propagation, 5,292 ducks and 1,053 geese. From propagated stock, 6 swans, 107 mourning doves, and 23 band-tailed pigeons also were produced. Of propagated birds, 20,613 ducks and 194 geese were liberated.

FOR DEPREDATION CONTROL

To enable permittees to protect crops, fishes, and other property from serious depredations by migratory birds, 407 permits were issued (by the Washington office of the Bureau, in a few instances, and by its regional directors). Many complaints of depredations were investigated by field agents of the Bureau and suggestions and aid given for relief without the necessity of killing the birds. In some instances where complaints were found to be without substantial foundation, permits were refused.

COOPERATIVE PREDATOR AND RODENT CONTROL

Cooperative predator and rodent-control operations during the year entailed expenditures of $644.774 from regular departmental appropriations, supplemented by $424.973 from cooperating States, $967,993 from cooperating counties, livestock associations, and others, and about $735,199 from emergency funds for control work con-

ducted under Bureau supervision. Predatory animals taken in this cooperative program numbered 104,076, exceeding last year's record by 10,036, and consisted of 93,093 coyotes, 1,214 wolves, 9,033 bobcats and lynxes, 495 bears, and 241 mountain lions. In rodent-control operations 35,465,078 acres were treated for reducing infestations of prairie dogs, ground squirrels, pocket gophers, jack rabbits, field mice, cotton rats, kangaroo rats, porcupines, and woodchucks. In addition, 212,591 premises were treated in cooperative campaigns for the elimination of common brown rats. A worth-while supplement to regular predator-control operations was made possible in Utah, Idaho, Wyoming, Montana, and Oregon through W. P. A. cooperation. Hunters were employed by that Administration to work, under Bureau supervision, on programs furthering protection to range livestock.

CONTROL OF PREDATORY ANIMALS

During the year coyotes held first place among predators of economic importance. In the range States they contributed heavily to livestock, poultry, and game losses, and in many sections they were more numerous than for many years and because of this increased their depredations. A survey made in Alaska revealed that coyotes and wolves are increasing there and that their depredations on reindeer herds are becoming more serious. Additional evidence that the coyote is making its appearance in the East was noted; during the fall of 1938 individuals were taken in Pennsylvania and in Maine, the first recorded cases of their presence in these States, and the species was found in new localities in Michigan. A contributing factor to the upward trend in coyote population has been the decreased activity of private trappers who formerly captured carnivorous animals for the cash value of the pelts. This situation is accounted for through the depressed market for the pelts, owing to general economic conditions and shifting demands in fur and fur products.

Appreciating the seriousness of the predator situation, New Mexico, Arizona, Oregon, Utah, and Montana, through their respective State legislatures, increased their cooperative funds for control work directed by the Bureau and other States maintained their contributions. State fish and game departments, livestock associations, and other agencies and individuals raised additional funds to expand cooperative control operations. In Missouri, where wolves and bobcats inflicted heavy losses in game refuges and parks, the State Conservation Council requested aid in alleviating the situation.

TYPICAL EXAMPLES OF PREDATION

Following are a few specific examples of recent losses caused by predatory wild animals:

Coyotes.—In the Western States coyotes are a constant menace to the sheep and poultry industries, and their depredations have been more widespread and in the aggregate more severe than those of all other predators. On a ranch in Montrose County, Colo., 40 lambs were killed in 2 weeks by a single two-footed coyote; on a ranch in northwestern Colorado 60 sheep were killed within 20 days; a hunter personally observed the killing of 6 deer and 23 sage chickens in Jackson County, Colo.; in Natrona County, Wyo., a sheepman esti-

mated his loss at $1,000 per band per year; an incorporated ranch in South Dakota offered a $500 reward for the capture of a single destructive coyote; on a ranch at Casa Grande, Ariz., 40 turkeys were killed in 1 night; early in 1939 a rancher near Wilcox, Ariz., lost 32 registered calves; an Arizona rancher lost 15 percent of his sheep while making a drive of 25 miles; a ranching company of Battle Mountain, Nev., reported the loss of 25 to 35 percent of the lamb crop in a band of 5,000 sheep.

Wolves.—In Atascosa County, Tex., wolves killed 20 goats on 1 ranch and 100 turkeys on another in a period of 20 days; the Catahoula Division of the Kisatchie National Forest, La., reported 50 cattle, 60 goats, and 150 hogs destroyed during the year; 8 wolves killed more than 50 cattle in Santa Cruz and Pima Counties, Ariz.; a single raid by wolves in another area of Santa Cruz County resulted in the death of 18 cattle and serious injury of 14 others.

Other predators.—A mountain lion killed 22 sheep in 1 night in western Juab County, Utah; so many colts were killed by mountain lions on the San Carlos Indian Reservation, Ariz., that the project for the improvement of Indian horses through the purchase of valuable brood mares and stallions was defeated; herders on the Battle Mountain division of the Medicine Bow National Forest, Wyo., reported 30 lambs on 1 bed ground killed by bears in 1 night; reports from 200 representatives of the Idaho Woolgrowers' Association revealed a yearly loss of 100,000 lambs and 40,000 ewes through predatory-animal depredations.

SOME RESULTS OF PREDATOR CONTROL

In 1930 coyotes were reported in Pearl River County, Miss., and by 1938 the sheep raisers had suffered such reductions in their flocks that the industry was no longer profitable. A Bureau hunter brought the situation under control, and the sheep industry of that county is now making definite strides toward recovery. Previous to 1938 a poultryman in Bee County, Tex., lost 46 of his 48 turkeys and 220 of his 230 chickens to coyotes. After a Bureau hunter took 476 predatory animals in the area the farmer again undertook poultry raising, beginning with 2 turkeys and a few chickens, and from this small stock has developed flocks without loss. In Washington, coyote control has resulted in a very noticeable increase in the number of game birds in the sagebrush areas, and in the pot-hole district of the State the ducks are no longer molested by predators.

In Stephens County, Tex., after 75 days of persistent effort, a Bureau hunter captured a crippled wolf that had killed $1,000 worth of sheep and goats on 1 ranch. When caught the animal had 1 forefoot missing, 2 toes off 1 hind foot, and the other hind foot broken. After Bureau hunters working in Hidalgo County, N. Mex., curtailed wolf migrations from Mexico, livestock losses in the vicinity were reduced. In the Santa Rita Mountains, near Patagonia, Ariz., a Bureau hunter captured a pair of wolves that had just previously killed a mature cow, 7 yearling cattle, 10 calves, and 4 deer.

In Hudspeth County, Tex., a marked increase of black-tailed deer was recorded, owing to previous mountain lion control. In Montrose County, Colo., a bear was taken that had killed 15 cattle in the preceding 2 months.

CONTROL OF INJURIOUS RODENTS

Field rodents, including ground squirrels, prairie dogs, kangaroo rats, and pocket gophers, continued to be the cause of serious losses in horticultural and other crops, range vegetation, and silvicultural plantings in the West, while tree-girdling mice raised havoc in rural sections of the East. Rats inflicted their usual heavy losses to growing crops and stored food supplies throughout the country, and damage by pocket gopher burrowings to mechanical soil-and-water-conserving structures continued.

Though damage in the aggregate was heavy, yet effective and persistent control measures conducted by various agencies cooperatively with the Bureau aided materially in reducing losses and preventing rodent depredations on many areas. Realizing the importance of rodent control in the conservation of range forage and water resources, users of winter ranges, through advisory boards of the Division of Grazing of the Department of the Interior, cooperated to a substantial degree in conducting rodent control on grazing areas. Cooperative rodent-control work also was conducted through the medium of C. C. C. camps operating under the jurisdiction of the Forest Service and the Soil Conservation Service of the Department of Agriculture and of the Division of Grazing, Bureau of Reclamation, and Office of Indian Affairs of the Department of the Interior. In addition, a number of effective W. P. A. projects were conducted. The work was supervised by trained personnel of the Survey and was undertaken only on areas where it would contribute to range rehabilitation, protection of irrigation and soil-conserving structures, silvicultural plantings, and farm crops.

RODENTS IN RELATION TO THE SPREAD OF DISEASE

Control work was stressed in areas of sylvatic plague prevalence to aid in stamping out the infection and curtailing its spread. On August 20, 1938, the Public Health Service reported plague infection in prairie dogs and field mice in Catron County, N. Mex., and on May 19 in kangaroo rats in Nona Ana County, N. Mex. During the year plague was found also among prairie dogs in Apache County, Ariz. These are believed to be the first positive findings of the disease in these States. Plague was also discovered among ground squirrels (*Citellus armatus*) in a new area in Utah, Rich County.

INSTANCES OF RODENT DAMAGE

Following are a few specific examples of recent damage by the principal species of rodents requiring extensive control:

Pocket gophers.—In Hopkins County, Tex., a farmer lost 10 percent of his 7,000-bushel sweetpotato crop through pocket gopher scars; 3 soil-conserving structures on a farm near Choudrant, La., were severely damaged by washing, because of runways; tunneling through extensive terrace structures, designed to lessen soil erosion and prevent floods on the Wasatch Forest, Utah, became so serious as to defeat the purpose of the terracing; in Titus and Morris Counties, Tex., burrows so undermined the highways that the pavement settled and broke and runways caused erosion in the dirt shoulders.

Ground squirrels.—In Moffat County, Colo., the depredations of ground squirrels were so severe that removal of these rodents must precede any land-use program for the area.

Meadow mice.—The hurricane and floods of September aggravated the damage inflicted by meadow mice to fruit trees in Rhode Island and Connecticut by uprooting the trees, thus exposing the roots and crowns to field mice and furnishing channels to the lower roots, where severe girdling resulted. In 1 orchard 85 of 105 trees were thus damaged. Floods also forced the mice from the lowlands into the orchards. Damage was especially severe in parts of the Northeastern States where no control work had been done by the Bureau in the previous year. One orchardist near Sodus, N. Y., lost 2,500 apple trees through tree-girdling mice. In Delaware 50 peach trees in 1 orchard were severely damaged by pine mice.

Rats.—The ever-normal-granary program of the Department in some States was interfered with by rats. Farmers along bottom lands of the Ohio River and its tributaries were forced to replant their crops, some as many as three times; one poultry plant in Massachusetts reported the annual loss caused by rats as $12,000; near Randall, Tex., a poultry farmer sustained a $75 loss of baby chicks; on a poultry farm in Leicester, Mass., 600 baby chicks were killed by rats in 1 night; and at Lubbock, Tex., a packing plant suffered a $500 loss to its storage stocks.

SOME BENEFITS OF RODENT CONTROL

Organized control of ground squirrels conducted during the past 2 years in Grand County, Colo., has resulted in nearly complete suppression of these rodents. Range grasses have shown a remarkable recovery, and severe ground squirrel depredations to head lettuce, an important cash crop of the area, have been eliminated.

Organized country-wide prairie dog control in Delta and Montrose Counties, Colo., during the last 4 years has made it possible for crops again to grow on many areas, whereas previous rodent infestation had been so severe that on many fertile tracts agriculture had been abandoned. In Moreno Valley in northern New Mexico, prairie dog control on heavily infested lands, conducted during the spring of 1939, allowed farmers to raise crops of potatoes, peas, beans, and oats. After 3 years of prairie dog control on a 40-section ranch in Texas, where 99 percent of the rodents were eliminated, the range so far recovered as to carry 1,000 more cattle and 4,000 more sheep than previously.

Pocket gopher-control operations on plantations of the Kisatchie National Forest, La., reduced damage to seedling trees to practically nothing.

In March the Galveston (Tex.) Wharf Co. reported only 6 sacks of flour cut into by rats on its wharves, this being the first damage of the kind reported in the approximately 18 months since cooperative rat-control has been underway. Before control measures were instituted it was not uncommon to have as many as 25,000 sacks cut into every month and flour shipping and storage on several piers had had to be abandoned. Cooperative rat control at Port Gibson, Miss., was so effective that in a single grocery store only an occasional sign of rat damage was noticeable, whereas the annual loss to the store through rat damage previously had been estimated at $300.

In certain orchards of the Northeastern States, where control of meadow mice had been practiced the previous year, damage was reduced to a negligible figure, whereas in untreated areas losses were extremely heavy.

A nurseryman of Stephensville, Tex., reported a $1,000 loss to nursery stock by rabbits before control measures terminated the depredations.

Repellent sprays against rabbits, applied to 4,000,000 slash pine seedlings in the Stuart Nursery of the Kisatchie National Forest, La., resulted in substantially reduced damage, increased sprouting, and greater survival of seedlings.

SUPPLY DEPOT AND LABORATORY

An addition to the supply depot and laboratory at Pocatello, Idaho, was practically completed by the Bureau in cooperation with the W. P. A. and the Pocatello Chamber of Commerce. The plant now provides additional laboratory facilities for scientifically compounding baits and for testing various baits and their toxic ingredients, space for storing rodent-bait materials and field supplies, and facilities for preparing special field equipment and pyrotechnic cartridges for use in rodent control. In cooperation with the Pocatello Chamber of Commerce, the supply depot prepared and distributed to cooperators in the United States 1,774,882 pounds of rodent-bait materials, as well as special bags, predatory-animal traps, and rodent-control equipment.

RESEARCH IN CONTROL METHODS

The Control Methods Research Laboratory, at Denver, Colo., made progress in developing and perfecting methods for the control of field rodents, including repellent sprays for the protection of seedling trees in silvicultural plantations. Ecological studies of rodents and predatory animals were continued looking toward the development of improved control methods; experiments were undertaken for the improvement of traps and trapping technique, as well as other methods of taking predatory animals; and predatory-animal baits for use in cooperative control work were processed and prepared.

RODENT CONTROL AND FOREST REGENERATION

Because of heavy pocket gopher, mouse, and rabbit damage, it is impossible on many cut-over and planted areas to get stands of natural reproduction or planted seedlings. In the words of an official of the Southwest Range and Forest Experiment Station: "One might almost say that given average precipitation and a good seed supply, seedlings will become established wherever rodents are excluded, but in no place where they are present." Research has been conducted on the protection of seeds in spot plantings until they can germinate and grow beyond danger of destruction by small rodents. An effective rodent bait was developed that can be used in more extensive silvicultural plantations and natural reproduction areas, and a method of exposure devised that will afford protection to other forms of wildlife. Repellent sprays were developed, and when applied to nursery seedlings, reduced the damage by cottontail rabbits from 40

to 3 percent. Studies are under way for the development of a spray that will be effective in repelling other species of rabbits from seedling stock.

STUDIES OF MEADOW AND PINE MICE

Methods of controlling meadow and pine mice in the Northeastern States have been improved as to time of year and method of application of baits, as a result of more detailed studies of the life habits of these rodents. A motion picture was made to demonstrate to orchardists the natural habits of these mice, the type of damage done, and methods of effective control.

TOXICITY AND FUMIGANT INVESTIGATIONS

Toxicity studies of red squill, an important ingredient of rat baits, progressed, and a standard method of bioassaying the product was further developed. In a cooperative undertaking by the Bureau of Biological Survey, the Bureau of Plant Industry, and the American University of Beirut, a research study was inaugurated at Beirut, Lebanon, Syria, for determining the relationships of toxicity of squill bulbs to growing and cultural conditions. Cooperative studies also continued along the line of extracting the toxic principle of red squill.

Improvement was made in the development of poison-gas pyrotechnic cartridges that can be used readily and safely in the control of burrowing rodents. Studies were also made for perfecting other fumigants and methods of applying them.

WILDLIFE CONSERVATION IN ALASKA

CHANGES IN REGULATIONS

The Secretary's regulations for 1939–40 relating to game, land fur animals, and birds in Alaska were published in Alaska Game Commission Circular No. 17 in June. They provide for a free certificate for native Indians or Eskimos of one-half or more Indian or Eskimo blood, in lieu of the $2 resident hunting and trapping license formerly required. To safeguard further the livelihood of the natives and to conserve the fur animals of the Territory, the regulations require that applicants for resident-trapping licenses must have resided in Alaska continuously for 3 years to be eligible therefor. Since black bears, including the brown and blue color variations, are now being sought as trophies of the hunt rather than for their pelt value, the regulations transferred them from the status of fur animals to that of game. An open season is provided for all fur animals except beavers in fur district 1, which was closed to trapping during the season 1938–39, and an open season on beavers is provided during the spring of 1940 in fur districts 2, 4, and 5. Seasons on martens were also fixed throughout the Territory.

LAW ENFORCEMENT

Two patrols of outstanding importance in the enforcement of the Alaska Game Law should be mentioned. In the remote headwaters of the Kuskokwim River, an Alaska wildlife agent and his deputy traveled more than 600 miles on snowshoes during the 6 weeks pre-

ceding the open trapping seasons, undergoing grueling hardships when forced to spend several nights in the open with temperatures ranging from −30° to −60° F. They succeeded in apprehending 5 poachers of long standing and seized the skins of 26 martens and 1 mink. In every case convictions were obtained and substantial fines and jail sentences were imposed. One violator demanded trial by a jury composed almost entirely of neighboring trappers, which to his surprise quickly brought in a verdict against him. The other 4 then pleaded guilty.

In a cooperative patrol with the mounted police of Canada, 2 other wildlife agents covered about 3,500 miles by air in a month and in addition traveled many miles on snowshoes and skis over trap lines along both sides of the Alaska-Yukon boundary. They uncovered evidence that residents of Alaska and Canada were promiscuously trapping in the territory across the boundary. They found and broke up a ring well organized for smuggling wolf and coyote pelts and leg bones into Alaska from Canada for collecting the $20 Territorial bounty. In 1 instance, 84 leg bones of wolves and coyotes were seized from a Canadian mail carrier enroute to a trading post in Alaska, and at Dawson he was found guilty on 4 separate counts, involving illegal trading and the possession and use of poison. They apprehended 8 violators and seized large quantities of furs, which were forfeited to the respective Governments. In the possession of 1 trader were found 7 quarters of mountain sheep meat, for which he was receiving 30 cents a pound. The agents also halted considerable traffic in other kinds of game animals. The air patrol was made extremely hazardous by adverse winter weather and lack of landing fields, which necessitated landing on and taking off from frozen rivers, lakes, and open stretches, but it resulted in a better understanding with Canadian authorities and will have the effect of discouraging indiscriminate violations long associated with the wilderness section through which the boundary line runs.

One wildlife agent of the Alaska Game Commission flew his own airplane extensively along the bleak Arctic coast, low enough to inspect trap lines and spot evidences of violations. On patrols ranging from Prince William Sound to the Arctic Ocean, he covered approximately 12,000 miles, several times furnishing air transportation to agents in whose districts he was flying. The excellent results obtained by this agent, noted in better observance of the game laws, strongly indicate the need of Government-owned and operated airplanes for work in enforcing game and fur laws in Alaska, as under present-day conditions flying is the only effective method of patrolling the vast hunting and trapping areas in the Territory.

In all, 252 violations were reported, as compared with 346 during the previous year. These included 33 involving illegal acts by aliens. Fines in the amount of $8,705 were imposed, in addition to jail sentences aggregating 3,614 days. The 700 furs seized included 399 beaver, 68 marten, 58 mink, 48 muskrat, 45 weasel, 24 red fox, 20 land otter, 15 white fox, 11 lynx, 5 cross fox, 2 polar bear, 2 wolverine, 2 black bear, and 1 wolf. A total of 25 game animals and 7 game birds illegally taken—namely, 11 deer, 5 caribou, 5 moose, 3 brown and grizzly bears, 1 goat, 6 ducks and 1 swan—and 60 firearms, 66

traps, and 16 snares were seized. The estimated value of the confiscated furs, guns, and traps was $8,632.

WILDLIFE-RESTOCKING PROJECTS

Through the courtesy of the Washington State Game Department, 864 eggs of Mongolian pheasants and 30 of chukar partridges were received at the Territorial experiment stations at Petersburg and Matanuska, and from those hatched it is hoped to develop adequate breeding stock. Wild wolverines and timber wolves were sent from Alaska to the Wisconsin Conservation Department in exchange for game birds of hardy varieties, including the brown, blue-eared, and cheer pheasants. Population increases demonstrate a growing need for game birds of this type in Alaska, for although the Territory has an abundance of native ptarmigans and grouse, epizootics sweep them away at intervals.

The plantings of beavers, snowshoe hares, and muskrats on Kodiak Island a few years ago have resulted in gratifying increases, and the 8 elk placed on Afognak Island in 1927 have multiplied to a herd of well over 100. The 19 buffaloes transplanted from Montana to the Big Delta region near Fairbanks in 1928 have now increased to a herd of approximately 150, including 1 albino calf. The flock of 18 mountain goats transplanted in 1923 from the mainland near Juneau to Baranof Island near Sitka is also reported to have passed the 100 mark. The initial stock of 34 musk oxen, received at Fairbanks from Greenland in 1929 and transferred to Nunivak Island Wildlife Refuge, has multiplied to more than 60.

PREDATOR CONTROL

Predatory-animal control was continued in the Territory on a limited scale under Bureau supervision and in cooperation with the Reindeer Service of the Office of Indian Affairs and the Alaska Game Commission. The Bureau's participation was limited to instructions to private trappers, distribution of scent materials and trapping equipment, and a general study of the problem. At its last biennial session the Territorial Legislature amended the law providing a $20 bounty on wolves and coyotes so as to require certification of all bounty claims by wildlife agents of the Commission. Carrying out the provisions of the amended law is expected to develop much information regarding these predators that will have a valuable bearing on future control measures. Following a complaint from Kodiak Island that certain brown bears were killing cattle, two observers, under the direction of a wildlife agent of the Commission, went to the island in March to make a study of the situation, remaining there through June.

RESEARCH ON ALASKAN WILDLIFE

Bureau studies are being made of the Kenai moose, the largest American hoofed animal, particularly of its abundance and relation to agricultural developments. An estimate in 1933 indicated 1,300 animals, but in the fall of 1938 investigation showed a reduction to 1,033. There seems to be a disproportionate number of bulls to cows

and a calf crop below normal. On Kodiak Island a preliminary study was made of wildlife problems, particularly of the relationships of the brown bear to cattle and of beaver operations to cattle range and fishing interests. A biologist spent 2 months in a reconnaissance of the Aleutian Islands, making representative collections of wildlife and investigations as to proper wildlife use of the various islands.

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REPORT OF THE CHIEF OF THE COMMODITY EXCHANGE ADMINISTRATION, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
COMMODITY EXCHANGE ADMINISTRATION,
Washington, D. C., September 25, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith a report of the work of the Commodity Exchange Administration for the fiscal year ended June 30, 1939.

Sincerely yours,

J. W. T. DUVEL, *Chief.*

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INTRODUCTION

Trading for future delivery in the principal agricultural commodities fell off sharply during the fiscal year. In a number of commodities trading reached the lowest levels since volume-of-trading information has been compiled. The volume of futures trading in grains declined 38 percent below the 1938 total and was only 48 percent of the annual average for the 10 years 1929–38. Cotton-futures transactions declined 19 percent below the 1938 figure and aggregated only 37 percent of the 10-year average. Trading in butter, egg, and potato futures also declined. The only commodities under Federal supervision which recorded an increase for the year were millfeeds and wool tops.

As a natural consequence of this decline in the volume of futures trading, a precipitate drop in its dollar value was also recorded. During the 10 years 1929–38 futures trading in the regulated commodities had an estimated value of

23 billion dollars a year. This declined in 1938 to 13 billion. For 1939 it was only $6,700,000,000, a decline of 48 percent from the 1938 total and of 71 percent from the 10-year average. The estimated value of futures transactions in each commodity for the three periods is shown in table 1.

TABLE 1.—*Volume and estimated contract value of futures trading in commodities under the Commodity Exchange Act, 1928–37 average, and fiscal years [1] 1938 and 1939*

Commodity	Unit	Volume of future trading			Decline 1938–39	Estimated value of futures trading			Decline 1938–39
		10-year (1928–37) average	1938	1939		10-year (1938–37) average	1938	1939	
					Percent	*Million dollars*	*Million dollars*	*Million dollars*	*Percent*
Wheat	Million bushels.	11,259.7	9,752.0	5,505.2	43.5	11,519.5	8,969.4	3,875.6	56.8
Corn	do	3,928.0	1,973.0	1,575.4	20.2	3,092.2	1,361.4	768.8	43.5
Oats	do	915.7	418.0	329.6	21.2	367.5	121.2	92.6	23.6
Rye	do	428.4	207.0	184.7	10.8	324.9	138.7	80.7	41.8
Barley	do	70.1	22.0	11.9	46.0	44.5	10.6	6.1	42.0
Flaxseed	do	29.2	14.0	11.4	18.6	59.8	27.3	20.3	25.5
Cotton	Million bales	102.5	47.7	38.5	19.4	7,311.9	2,104.8	1,663.1	21.0
Butter	Carlots	[2] 24,859	17,287	8,162	52.8	[2] 134.8	99.2	39.0	60.7
Eggs	do	[2] 41,796	47,792	43,909	8.1	[2] 109.7	118.0	107.4	9.0
Potatoes	do	[2] 1,891	259	231	10.8	[2] 1.8	.1	.1	.7
Millfeeds	Tons	[2] 569,000	446,950	480,300	[3] 7.5	[2] 12.3	8.4	7.3	12.8
Wool tops	Million pounds	12.4	61.4	64.7	[3] 5.0	12.7	56.1	54.1	3.6
Total						22,991.6	13,015.3	6,715.3	48.4

[1] July 1 to June 30. [2] 4-year average. [3] Increase.

This low level of trading occurred at a time when prices were unusually low. Low prices naturally reduced the incentive which producers, dealers, and processors would otherwise have had to hedge their supplies. Other factors in the decline were the Government loans, Government purchases of agricultural products for relief purposes, and lack of speculative incentive. A few speculators accustomed to trade in very large quantities and resenting the regulatory activities of the Administration may have entered markets which are not under Federal supervision.

The relatively low level of agricultural prices naturally has raised the question in the minds of farmers and others whether the speculative transactions of large traders in the futures markets may have been a contributing cause. It has even been charged that a group of international speculators have been depressing prices through their operations on American markets. There is no apparent foundation in fact for such statements. The Administration requires every trader whose daily operations or open commitments in one future equal or exceed certain totals (200,000 bushels of grain, 5,000 bales of cotton, 25 carlots of butter, eggs, or potatoes, etc.) to report daily his trading operations. The Administration therefore knows at all times who the large traders are and what their open commitments and daily operations are. While it is true that at times in the past speculators have made very large short sales in a manner to aid in depressing prices, no such instances were found during the year. On the contrary, the large operators have been quite uniformly on the long side of the market.

It does not appear that any group of foreign speculators has operated on American markets in such volume as to have any appreciable effect upon prices. The transactions of the few foreign traders who have been trading in American markets have been so small as to be almost negligible, as is revealed on pages 9 and 17.

GRAIN

VOLUME OF TRADING

Trading in all grains on all contract markets during the year totaled 7,618,000,000 bushels, a decline of 38 percent from the 12,386,000,000 total for 1938 and

of 52 percent from the 15,780,000,000 annual average for the 10-year period 1929–38. Trading in grain futures has declined 70 percent from the 1930 high record of 25,000,000,000 bushels.

Seventy-two percent of the total trading in all grain futures in 1939 was in wheat, 21 percent in corn, 4 percent in oats, 2 percent in rye, and less than 0.5 percent each in barley and flaxseed. Table 2 shows the volume of trading for the last 10 years.

TABLE 2.—*All grains: Annual volume of trading in wheat, corn, oats, rye, barley, and flaxseed, all contract markets combined in fiscal years, 1929–39* [1]

[In millions of bushels, i. e., 000,000 omitted]

Year	Wheat	Corn	Oats	Rye	Barley	Flaxseed	All grains
1929	12,195	5,831	692	443	82	48	19,291
1930	19,607	3,668	946	644	97	38	25,000
1931	10,063	5,505	842	498	81	45	17,034
1932	10,148	2,639	382	342	31	24	13,566
1933	10,890	2,425	571	256	79	26	14,247
1934	10,093	3,314	1,457	495	164	18	15,541
1935	8,097	3,725	837	425	54	9	13,147
1936	8,644	1,403	655	258	30	17	11,007
1937	11,659	2,952	1,506	411	41	8	16,577
1938	9,752	1,973	418	207	22	14	12,386
Average	11,115	3,343	831	398	68	25	15,780
1939	5,505	1,575	330	185	12	11	7,618

[1] Contract markets are those commodity-futures markets which have been authorized by the Administration to conduct futures trading.

TRADING ON VARIOUS MARKETS

As has been generally true in the past, most of the trading in grain futures was conducted on the Chicago Board of Trade. That market accounted for 79 percent of the trading in wheat, 95 of that in corn, 82 of that in oats, and 63 percent of that in rye. As table 3 shows, the Kansas City Board of Trade was the second largest wheat market, with a total of 558,681,000 bushels and the Minneapolis Chamber of Commerce third, with 404,458,000 bushels.

TABLE 3.—*Total volume of trading in wheat, corn, oats, rye, barley, flaxseed, and all grain futures combined, by contract markets, fiscal year 1939*

[In thousands of bushels, i. e., 000 omitted]

Market	Wheat	Corn	Oats	Rye	Barley	Flaxseed	All grains	
								Percent
Chicago Board of Trade	4,372,121	1,493,893	270,785	116,548	0		6,253,347	82.1
Chicago Open Board	114,309	18,129	1,807	847			135,092	1.8
Kansas City	558,681	41,654	10				600,345	7.9
Minneapolis	404,458	18,962	55,915	66,748	11,822	11,337	569,242	7.5
Duluth	48,065			71	0	60	48,196	.6
Milwaukee	3,793	2,730	1,065	475	0		8,063	.1
St. Louis [1]	0	0	0				0	
Seattle	3,630						3,630	(2)
Portland	125						125	(2)
San Francisco	0				48		48	(2)
Los Angeles					16		16	(2)
Total	5,505,182	1,575,368	329,582	184,689	11,886	11,397	7,618,104	
Chicago Board of Trade to all contract markets	*Percent* 79.4	*Percent* 94.8	*Percent* 82.2	*Percent* 63.1	*Percent*	*Percent*	*Percent* 82.1	

[1] No trading in wheat and corn futures since April 1938; no trading in oat futures since August 1937.
[2] Less than 0.1 percent.

Trading in barley futures was restricted almost entirely to the Minneapolis Chamber of Commerce, which accounted for 99 percent of the total. That market also accounted for 99 percent of all trading in flaxseed.

AVERAGE DAILY VOLUME OF TRADING

Table 4 shows the average daily volume of trading as well as the largest and smallest amounts of trading in a single day. It is interesting to note that the largest amount of trading in wheat in a single day in 1939, 57,295,000 bushels, was only slightly above the average daily volume of trading in 1930, 54,963,000 bushels.

TABLE 4.—*Dates when largest and smallest day's trading occurred in grain futures on specified markets, fiscal year 1939*

[In thousands of bushels, i. e., 000 omitted]

Market	Commodity	Average daily volume of trading	Largest amount of trading in single day		Smallest amount of trading in single day	
			Quantity	Date	Quantity	Date
Chicago Board of Trade	Wheat	14,525	57,295	Sept. 14, 1938	2,596	Mar. 11, 1939
	Corn	4,963	15,582	June 30, 1939	988	Mar. 4, 1939
	Oats	900	3,886	May 25, 1939	110	Jan. 28, 1939
	Rye	387	2,196	May 26, 1939	21	Mar. 24, 1939
Chicago Open Board	Wheat	380	1,225	July 14, 1938	62	Feb. 24, 1939
Kansas City Board of Trade	Wheat	1,856	6,353	July 5, 1938	241	Dec. 24, 1938
	Corn	138	926	Oct. 7, 1938	13	Apr. 12, 1939
Minneapolis Chamber of Commerce	Wheat	1,344	3,751	May 24, 1939	297	Feb. 25, 1939
	Oats	186	834	Aug. 30, 1938	25	Feb. 8, 1939
	Rye	222	1,318	May 26, 1939	22	Feb. 15, 1939
	Barley	39	395	Aug. 31, 1938	0	(1)
	Flaxseed	38	368	Aug. 23, 1938	0	(1)
Duluth Board of Trade	Wheat	160	912	Sept. 6, 1939	10	Feb. 16, 1939

[1] Occasional days of no trading.

OPEN CONTRACTS

The term "open contracts" relates to the total of all futures contracts existing and unfulfilled as of a given date. Figures on open contracts represent the amount of a commodity which would pass from sellers to buyers if all then-existing contracts were settled by delivery and no portion of such commodity was applied in settlement of more than one contract. The term "commitments" as used herein relates to the contractual obligations of buyers and sellers. In the aggregate, total long commitments must equal the total short commitments, and each is equal in amount to total open contracts.

Figures for total open contracts as published by the Administration are compiled from reports on individual commitments held through clearing members of exchanges. Since some nonclearing members carry only their net positions, long or short, with clearing members, the grand total of open contracts is somewhat greater than the published figures would indicate. The underestimation is probably about 5 percent.

Table 5 compares the average daily open contracts on all contract markets with the visibly supply.

TABLE 5.—*All grains: Average daily open contracts, all contract markets combined, compared to average visible supply of regulated grains in United States, fiscal year 1939*

Grain	Average daily open contracts	Average visible supply in United States	Comparison of open contracts with visible supply	Grain	Average daily open contracts	Average visible supply in United States	Comparison of open contracts with visible supply
	1,000 bushels	*1,000 bushels*	*Percent*		*1,000 bushels*	*1,000 bushels*	*Percent*
Wheat	123,240	104,158	118.3	Rye	8,088	6,822	118.6
Corn	56,315	33,204	169.6	Barley	652	12,071	5.4
Oats	15,818	14,324	110.4	Flaxseed	619	836	74.0

The largest amount of open contracts in wheat futures on the Chicago Board of Trade recorded during the year was 121,976,000 bushels, on August 29, 1938. The largest amount ever recorded was 248,294,000 bushels on October 16, 1929. The average daily open contracts on all contract markets in wheat of 123,000,000 bushels was slightly greater than the 10-year average of 120,000,000 bushels. The average daily open contracts on all contract markets in corn of 56,000,000 bushels also exceeded the 10-year average of 50,000,000 bushels.

The seasonal trend in the volume of open contracts in wheat and corn is shown in tables 6 and 8.

SPECIAL ACCOUNTS

Considerable interest attaches to the scale of trading operations on the various contract markets. Are these markets dominated by the operations of a few large traders, or are they characterized by a multitude of transactions made for a large number of small traders? No single answer can be given. The importance of large traders varies from time to time, and important differences are to be observed between commodities. Significant information, however, is secured when the commitments of these traders are classified according to market position (long or short), and according to purpose, i. e., hedging, speculative, or spreading. This classification is available currently only for large traders. Nevertheless, it provides considerable insight into the composition of the markets for the various commodities.

Information on large positions in futures markets is secured from reports which must be filed with the Administration by each individual or firm attaining a position, long or short, as large as a specified amount. For grains this amount is 200,000 bushels in a single future on any one contract market. The reports filed show daily the positions held in each future and each market, including foreign markets as well as contract markets. The positions are classified to show how much is hedging, how much spreading, and how much is absolute-price speculation. On Friday of each week an additional report showing the cash-grain position is required. This shows stocks of grain on hand and forward purchases and sales. It provides a check on the classification of futures positions as hedging or speculative.

During the year reports were received at various times from 289 different individuals or firms showing positions in wheat futures. Although the measurement is made in total commitments rather than by quantity of trading done, those making these reports may properly be called the large traders in wheat futures. Table 6 shows for each month the daily average of the aggregate positions in wheat futures on the Chicago Board of Trade held by large traders who reported positions in that market. The average aggregate positions of small traders are also shown. Small traders are those who at the time have positions less than the reporting requirement and their combined positions are estimated by subtracting the figures for large traders from total open contracts.[1] It may be seen that large traders held the predominant positions on the short side of the wheat market during the past year, their average total position on the short side amounting to about 70 percent of total short commitments. The major portion of this short interest took the form of hedging. Positions reported as hedging by large traders constituted nearly 60 percent of the total short commitments.

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[1] As indicated above, open contracts as reported understate the actual total of open contracts. For this reason the positions of small traders are underestimated by this method of computation. The size of the error is probably about 5 percent of the total open contracts.

TABLE 6.—*Wheat, all futures on Chicago Board of Trade: Average daily total commitments of reporting traders classified according to purpose, and estimated total commitments of traders not subject to reporting requirement, fiscal year 1939*

[In millions of bushels—i. e. 000,000 omitted]

Year and month	Total open contracts [1]	Small traders estimated [2]		Traders subject to 200,000-bushel reporting requirement reported as—						Total	
				Speculative		Hedging		Spreading			
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938											
July	86.8	63.7	29.8	4.1	3.7	9.6	43.9	9.4	9.4	23.1	57.0
August	113.6	86.4	27.4	7.3	.5	7.9	73.9	12.0	11.8	27.2	86.2
September	110.3	86.8	22.8	8.4	1.2	4.9	76.1	10.2	10.2	23.5	87.5
October	113.2	87.7	25.9	10.2	1.0	3.3	75.1	12.0	11.2	25.5	87.3
November	115.5	94.0	29.0	7.1	1.7	2.6	73.8	11.8	11.0	21.5	86.5
December	101.0	79.3	23.8	9.0	2.6	2.7	64.4	10.0	10.2	21.7	77.2
1939											
January	92.8	74.7	26.4	7.8	1.6	1.1	55.4	9.2	9.4	18.1	66.4
February	88.2	71.6	27.0	6.7	2.1	1.8	50.3	8.1	8.8	16.6	61.2
March	83.2	66.5	27.1	6.3	1.9	1.7	45.4	8.7	8.8	16.7	56.1
April	71.2	54.2	25.7	6.5	2.0	1.5	35.4	9.0	8.1	17.0	45.5
May [3]	68.7	49.9	22.7	7.9	1.8	3.2	36.4	7.7	7.8	18.8	46.0
June [3]	73.5	55.0	21.0	9.8	2.0	2.4	43.1	6.3	7.4	18.5	52.5
Average [4]	93.1	72.4	25.7	7.6	1.8	3.6	56.1	9.5	9.5	20.7	67.4

[1] See description of method of compiling these figures in section on "Open contracts."
[2] See footnote, p. 5.
[3] Preliminary data.
[4] Average for year (301 trading days).

It will be noted that the aggregate speculative positions of large traders averaged 7,600,000 bushels long and 1,800,000 bushels short. Their total long speculative positions averaged more than four times their total short positions. The greater part of the long interest in the market was held by persons not subject to the reporting requirement. About 80 percent of the long commitments in wheat was held by persons who at the time were not required to report.

Positions in foreign as well as domestic markets are shown by persons in reporting status. The total commitments in wheat reported in all contract markets and in foreign markets are shown in table 7. About 90 percent of the long positions and 81 percent of the short positions reported were in domestic markets. Most of the trading in foreign markets consisted of hedging, which averaged 16,500,000 bushels in short commitments and 1,400,000 in long commitments.

TABLE 7.—*Wheat futures: Average daily total commitments of reporting traders in domestic and foreign markets classified according to purpose, fiscal year 1939*

[In millions of bushels]

Year and month	Total commitments in domestic markets reported as—							
	Speculative		Hedging		Spreading		Total	
	Long	Short	Long	Short	Long	Short	Long	Short
1938								
July	4.4	3.9	17.2	63.1	9.9	10.3	31.5	77.3
August	8.5	.5	16.5	98.8	12.5	12.3	37.5	111.6
September	8.9	1.2	13.8	101.3	10.6	10.4	33.3	112.9
October	11.3	1.0	9.9	98.8	12.9	11.3	34.1	111.1
November	8.5	1.7	6.6	97.7	14.5	11.2	29.6	110.6
December	10.9	2.6	6.5	86.8	12.7	10.6	30.1	100.0
1939								
January	7.9	1.7	4.5	76.9	14.2	9.7	26.6	88.3
February	6.8	2.1	4.4	71.0	12.9	8.9	24.1	82.0
March	6.3	1.9	4.6	65.0	13.3	9.0	24.2	75.9
April	7.1	2.0	4.7	52.5	12.4	8.4	24.2	62.9
May [2]	8.4	1.8	6.6	53.1	10.4	8.1	25.4	63.0
June [2]	10.0	2.0	6.7	63.3	10.3	7.7	27.0	73.0
Average [3]	8.2	1.9	8.6	77.3	12.2	9.8	29.0	89.0

See footnote at end of table.

TABLE 7.—*Wheat futures: Average daily total commitments of reporting traders in domestic and foreign markets classified according to purpose, fiscal year 1939*—Continued

Year and month	Total commitments in foreign markets reported as—								Total	
	Speculative		Hedging		Spreading		Total			
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938										
July	1.4	0.8	1.9	7.7	1.2	1.0	4.5	9.5	36.0	86.8
August	.4	1.7	3.7	6.5	.9	1.4	5.0	9.6	42.5	121.2
September	.9	1.5	1.2	15.5	.8	1.2	2.9	18.2	36.2	131.1
October	.9	1.6	1.3	25.9	.6	2.5	2.8	30.0	36.9	141.1
November	.6	1.8	.4	25.2	1.2	4.8	2.2	31.8	31.8	142.4
December	.7	1.8	(1)	25.9	1.6	3.8	2.3	31.5	32.4	131.5
1939										
January	.7	.2	.2	15.4	1.7	7.0	2.6	22.6	29.2	110.9
February	.6	.....	.5	14.7	1.5	6.3	2.6	21.0	26.7	103.0
March	.4	(1)	1.7	13.6	1.4	6.7	3.5	20.3	27.7	96.2
April	.5	.1	3.2	13.3	1.3	5.7	5.0	19.1	29.2	82.0
May [2]	.7	.1	1.2	17.2	1.2	3.4	3.1	20.7	28.5	83.7
June [2]	.2	.1	.9	18.1	1.0	3.6	2.1	21.8	29.1	94.8
Average [3]	.7	.8	1.4	16.5	1.2	3.9	3.3	21.2	32.3	110.2

[1] Less than 50,000 bushels. [2] Preliminary data. [3] Average for year (301 trading days).

It may be concluded that from July 1, 1938, to June 30, 1939, the predominant short positions in wheat futures were those of grain merchants, flour mills, and other hedgers. Speculative positions, on the other hand, were principally on the long side and were largely held by persons whose operations were so small that they were not required to make special reports.

Reports on positions in corn futures at some time during the year were received from 128 reporting traders. The large trader played a relatively more important role in corn futures trading than in wheat futures trading. This may be seen in table 8. Short hedges in corn were of about the same relative importance as those in wheat, but long hedges were greater in corn. Large long, speculative commitments in corn were approximately 14 percent of all long commitments, as compared with about 8 percent in wheat. In corn as in wheat the large speculators were predominantly on the long side of the market, their long commitments averaging 7,400,000 bushels and their short commitments 3,400,000 bushels.

TABLE 8.—*Corn, all futures on Chicago Board of Trade: Average daily total commitments of reporting traders classified according to purpose, and estimated total commitments of traders not subject to reporting requirement, fiscal year 1939*

[Millions of bushels, i. e., 000,000 omitted]

Year and month	Total open contracts [1]	Small traders (estimated) [2]		Traders subject to 200,000-bushel reporting requirement reported as—							
				Speculative		Hedging		Spreading		Total	
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938											
July	38.7	17.8	12.3	1.3	2.0	18.3	23.0	1.3	1.4	20.9	26.4
August	38.7	18.7	15.1	.9	4.2	16.6	16.8	2.5	2.6	20.0	23.6
September	36.2	17.4	13.9	.8	5.6	15.1	13.6	2.9	3.1	18.8	22.3
October	43.4	22.6	13.1	1.3	4.4	16.2	22.3	3.3	3.6	20.8	30.3
November	60.8	32.6	14.2	2.8	3.6	18.0	35.2	7.4	7.8	28.2	46.6
December	62.8	33.6	14.0	3.9	3.5	16.9	36.7	8.4	8.6	29.2	48.8
1939											
January	67.3	38.9	15.4	14.0	3.8	6.7	40.2	7.7	7.9	28.4	51.9
February	69.3	41.5	16.5	15.1	4.1	5.5	41.3	7.2	7.4	27.8	52.8
March	67.1	40.9	15.4	13.4	4.2	6.1	40.2	6.7	7.3	26.2	51.7
April	60.1	35.9	14.7	12.5	2.9	5.9	36.5	5.8	6.0	24.2	45.4
May [3]	52.3	29.4	11.7	11.1	1.6	5.6	32.8	6.2	6.2	22.9	40.6
June [3]	54.6	31.9	11.8	12.4	.9	4.8	36.4	5.5	5.5	22.7	42.8
Average [4]	54.1	30.0	14.0	7.4	3.4	11.3	31.1	5.4	5.6	24.1	40.1

[1] See description of method of compiling these figures in section on "Open contracts."
[2] See footnote, p. 5 [3] Preliminary data. [4] Average for year (301 trading days).

Small traders held about 55 percent of total long commitments in corn as compared with almost 80 percent in wheat.

There was little trading in corn futures on any domestic market other than Chicago, and positions in foreign markets held by large traders were considerably less than 1 percent of their positions in the Chicago market.

Commitments in oats and rye on the Chicago Board of Trade are classified in tables 9 and 10, respectively. Fifty-five individuals or firms reported positions in oats and 22 reported positions in rye at some time during the year. Holders of more than 200,000 bushels are much less important in futures trading in these grains than in wheat and corn. This is not surprising in view of the lighter trading and smaller scale of operation in the oat and rye markets. The reporting requirements of 200,000 bushels is almost 4 percent of the average of open contracts for rye and about 1½ percent of open contracts for oats. The same requirement constituted less than 0.4 percent of open contracts in corn and only 0.2 percent in wheat. Under the circumstances it is to be expected that a smaller proportion of total commitments will be reported on in oats and rye.

TABLE 9.—*Oats, all futures on Chicago Board of Trade: Average daily total commitments of reporting traders classified according to purpose, and estimated total commitments of traders not subject to reporting requirement, fiscal year 1939*

[In millions of bushels, i. e., 000,000 omitted]

Year and month	Total open contracts [1]	Small traders (estimated) [2]		Traders subject to 200,000-bushel reporting requirement reported as—							
				Speculative		Hedging		Spreading		Total	
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938											
July	10.3	7.6	5.5	----	2.4	2.4	2.0	.3	.4	2.7	4.8
August	15.8	11.9	6.3	.1	.9	3.1	7.7	.7	.9	3.9	9.5
September	16.8	12.3	6.5	.2	.1	3.3	9.2	1.0	1.0	4.5	10.3
October	16.6	11.6	6.6	.1	.1	3.8	8.8	1.1	1.1	5.0	10.0
November	15.8	11.1	6.2	.3	.4	3.3	8.1	1.1	1.1	4.7	9.6
December	13.5	9.3	5.4	.2	.4	3.1	6.8	.9	.9	4.2	8.1
1939											
January	11.4	9.9	5.4	.3	.5	.2	4.5	1.0	1.0	1.5	6.0
February	11.7	10.1	5.7	.4	.5	.1	4.3	1.1	1.2	1.6	6.0
March	11.6	10.2	5.7	.4	.4	.1	4.5	.9	1.0	1.4	5.9
April	10.4	8.5	5.6	.7	.2	.1	3.5	1.1	1.1	1.9	4.8
May [3]	9.9	8.3	5.9	.7	.1	(4)	2.7	.9	1.2	1.6	4.0
June [3]	12.5	10.7	6.4	.6	.6	.5	3.9	.7	1.6	1.8	6.1
Average [5]	13.0	10.1	5.9	.3	.6	1.7	5.5	.9	1.0	2.9	7.1

[1] See description of method of compiling these figures in section on "Open contracts."
[2] See footnote, p. 5.
[3] Preliminary data.
[4] Less than 50,000 bushels.
[5] Average for year (301 trading days).

TABLE 10.—*Rye futures on Chicago Board of Trade: Average daily total commitments of reporting traders classified according to purpose, and estimated total commitments of traders not subject to reporting requirement, fiscal year 1939*

[In millions of bushels, i. e., 000,000 omitted]

Year and month	Total open contracts [1]	Small traders (estimated) [2]		Traders subject to 200,000-bushel reporting requirement reported as—						Total	
				Speculative		Hedging		Speading			
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938											
July	3.5	3.1	2.1	[3]	1.3	0.3	[3]	0.1	0.1	0.4	1.4
August	4.5	4.2	2.5	------	.7	.3	1.3	------	------	.3	2.0
September	5.0	4.4	2.1	[3]	------	.6	2.9	[3]	[3]	.6	2.9
October	5.3	4.6	2.1	0.1	------	.5	3.1	.1	.1	.7	3.2
November	5.6	4.7	1.9	.1	------	.5	3.4	.3	.3	.9	3.7
December	5.3	4.2	1.6	[3]	------	.8	3.4	.3	.3	1.1	3.7
1939											
January	5.7	4.7	1.7	.7	------	------	3.7	.3	.3	1.0	4.0
February	5.5	4.5	1.7	.7	------	------	3.3	.3	.5	1.0	3.8
March	5.5	4.5	1.8	.7	[3]	[3]	3.3	.3	.4	1.0	3.7
April	5.2	4.5	1.8	.5	------	[3]	3.0	.2	.4	.7	3.4
May [4]	5.2	4.3	1.4	.5	------	[3]	2.8	.4	1.0	.9	3.8
June [4]	7.7	6.5	1.8	.7	[3]	[3]	3.6	.5	2.3	1.2	5.9
Average [5]	5.3	4.5	1.8	.3	.2	.3	2.8	.2	.5	.8	3.5

[1] See description of method of compiling these figures in section on "Open contracts."
[2] See footnote, p. 5.
[3] Less than 50,000 bushels.
[4] Preliminary data.
[5] Average for year (301 trading days).

Although the proportion of total commitments held by reporting traders was smaller for oats and rye than for wheat and corn, the general patterns were quite similar. The aggregate positions of reporting traders were much larger on the short side than on the long side, and this was owing mainly to hedging operations. The positions of small traders were consequently chiefly long. Large speculators' positions in rye resembled those in wheat and corn since the aggregate long holdings were considerably greater than short speculative positions. In oats, on the other hand, short speculative positions were almost twice as great as aggregate long speculative positions held by reporting traders.

Holdings in foreign markets in oats and rye futures by persons required to report holdings of these grains were not of great importance, although there was some spreading in rye long Winnipeg—short Chicago late in the year.

Trading in barley and flaxseed is significant only at Minneapolis. The average of open contracts in each of these commodities was slightly over 600,000 bushels. The reporting requirement was therefore nearly 30 percent of average open contracts, and positions requiring reports were relatively rare, only six individuals or firms reporting positions in barley and two reporting positions in flaxseed during the year. It may be seen from table 5 that volume of open contracts in all grains except barley and flaxseed were such that the whole of the visible supply could have been hedged in the futures market throughout the year. It is obvious that in the case of barley the futures market plays a relatively minor role in carrying commercial stocks of that commodity.

TRADING BY FOREIGN INTERESTS

While the volume of transactions executed on American futures markets far surpasses that on foreign markets and some foreign interests find it advantageous to utilize American markets for hedging and other purposes, the total volume of business transacted on American markets by foreign interests was relatively unimportant.

Table 11 shows that of the monthly average of 93,800,000 bushels of total open contracts in wheat only 1,800,000 bushels, or 1.8 percent, on the short side and 1,200,000 bushels, or 1.2 percent, on the long side were held by foreign accounts.

Of the total foreign short holdings, 1,400,000 bushels, or 76 percent, were reported as hedges. Foreign speculative holdings averaged 1,200,000 bushels on the long side and less than 100,000 bushels on the short side. Large foreign speculative short holdings were therefore only 6 percent as great as the foreign long holdings and only 0.008 percent of the average total open contracts.

TABLE 11.—*Wheat: Total commitments reported by all persons subject to 200,000-bushel reporting requirement on the Chicago Board of Trade, end of each month, fiscal year 1939*

[In millions of bushels, i. e., 000,000 omitted]

Date	Total open contracts	Total reported commitments		United States, reported as—							
				Speculative		Hedging		Spreading		Total	
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938											
July 30	102.4	24.4	76.0	5.1	0.8	6.5	57.5	12.0	11.8	23.6	70.1
Aug. 31	119.4	28.7	92.4	9.0	.2	7.2	78.5	11.2	10.3	27.4	89.0
Sept. 30	105.2	22.2	82.7	5.9	.9	4.3	70.5	10.5	11.0	20.7	82.4
Oct. 31	117.9	26.1	89.5	8.4	.9	3.9	75.4	12.6	10.8	24.9	87.1
Nov. 30	108.2	19.2	82.5	5.4	2.5	2.8	67.8	10.0	10.3	18.2	80.6
Dec. 31	97.4	21.8	73.0	8.4	3.1	2.4	59.5	9.5	9.1	20.3	71.7
1939											
Jan. 31	90.4	16.6	64.2	5.3	1.8	1.1	52.7	8.0	8.6	14.4	63.1
Feb. 28	86.3	16.6	59.9	4.1	2.0	2.1	48.2	8.2	8.4	14.4	58.6
Mar. 31	79.0	17.0	52.0	5.4	2.0	1.6	40.5	9.0	8.1	16.0	50.6
Apr. 29	66.3	19.8	42.3	8.2	1.4	3.4	33.6	7.4	6.1	19.0	41.1
May 31	73.9	19.1	49.2	9.2	2.1	2.4	38.6	6.7	7.6	18.3	48.3
June 30	79.8	19.2	60.3	9.4	2.4	3.0	50.4	6.4	6.9	18.8	59.7
Average	93.8	20.9	68.7	7.0	1.7	3.4	56.1	9.3	9.1	19.7	66.9

Date	Foreign, reported as—							
	Speculative		Hedging		Spreading		Total	
	Long	Short	Long	Short	Long	Short	Long	Short
1938								
July 30	0.6		0.2	5.3		0.6	0.8	5.9
Aug. 31	1.2	0.6		2.1	0.1	.7	1.3	3.4
Sept. 30	1.5	.3					1.5	.3
Oct. 31	1.2			2.1		.3	1.2	2.4
Nov. 30	1.0			1.5		.4	1.0	1.9
Dec. 31	1.5			.9		.4	1.5	1.3
1939								
Jan. 31	2.2			.9		.2	2.2	1.1
Feb. 28	2.2			.9		.4	2.2	1.3
Mar. 31	1.0			.9		.5	1.0	1.4
Apr. 29	.8			.7		.5	.8	1.2
May 31	.8			.7		.2	.8	.9
June 30	.4			.6			.4	.6
Average	1.2	(1)	(1)	1.4	(1)	.4	1.2	1.8

[1] Less than 100,000 bushels.

Table 12 shows total commitments in corn futures reported by persons located in the United States and those outside. Of a monthly average of total open contracts of 54,600,000 bushels, large foreign accounts on an average held only 1,000,000 bushels, or 1.9 percent, on the long side and 500,000 bushels, or 0.1 percent, on the short side. As was true in the case of wheat, the average speculative long position of large foreign accounts exceeds their short position.

TABLE 12.—*Corn: Total commitments reported by persons subject to 200,000-bushel reporting requirement on the Chicago Board of Trade, end of each month, fiscal year 1939*

[In millions of bushels, i. e., 000,000 omitted]

Date	Total open contracts	Total reported commitments		United States, reported as—							
				Speculative		Hedging		Spreading		Total	
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938											
July 30	37.3	19.1	24.1	1.3	1.9	13.9	20.3	1.5	1.5	16.7	23.7
Aug. 31	39.5	20.3	24.8	1.2	4.8	15.6	16.9	2.7	2.8	19.5	24.5
Sept. 30	34.0	18.7	21.5	.6	4.7	14.4	13.7	2.9	3.1	17.9	21.5
Oct. 31	51.8	22.2	38.3	1.4	3.5	15.2	29.9	4.3	4.7	20.9	38.1
Nov. 30	64.2	30.8	49.3	3.4	3.1	17.9	36.3	8.7	9.1	30.0	48.5
Dec. 31	65.5	29.0	52.0	4.2	3.5	15.9	39.7	8.1	8.4	28.2	51.6
1939											
Jan. 31	68.5	27.6	51.9	5.0	2.5	14.6	40.9	6.9	7.1	26.5	50.5
Feb. 28	69.0	27.3	52.4	14.8	3.6	5.1	41.0	6.3	6.7	26.2	51.3
Mar. 31	65.4	25.9	50.3	12.4	4.1	6.1	38.9	6.8	7.3	25.3	50.3
Apr. 29	54.4	22.7	41.4	10.5	2.0	6.1	33.8	5.1	5.1	21.7	40.9
May 31	56.5	23.4	44.6	11.4	1.5	5.0	36.5	6.1	6.0	22.5	44.0
June 30	49.0	21.3	38.2	11.4	.3	5.1	33.3	3.9	3.9	20.4	37.5
Average	54.6	24.0	40.7	6.5	2.9	11.2	31.8	5.3	5.5	23.0	40.2

Date	Foreign, reported as —							
	Speculative		Hedging		Spreading		Total	
	Long	Short	Long	Short	Long	Short	Long	Short
1938								
July 30		0.4	2.4				2.4	0.4
Aug. 31		.3	.8				.8	.3
Sept. 30			.8				.8	
Oct. 31	0.5	.2	.8				1.3	.2
Nov. 30		.5	.8	0.3			.8	.8
Dec. 31		.2	.8	.2			.8	.4
1939								
Jan. 31		1.0	.8	(1)	0.3	.4	1.1	1.4
Feb. 28	.8	.8		(1)	.3	.3	1.1	1.1
Mar. 31	.6			(1)			.6	(1)
Apr. 29	.9			.4	.1	.1	1.0	.5
May 31	.9			.6	(1)	(1)	.9	.6
June 30	.5		.4	.7			.9	.7
Average	.4	.3	.6	.2	(1)	(1)	1.0	.5

[1] Less than 100,000 bushels.

ROUND-LOT AND JOB-LOT TRADING

Approximately 10 percent of all trading in grain futures on the Chicago Board of Trade was in job lots, as is shown in table 13. The largest percentage, 10.7, was in wheat; the second largest, 10.2, was in corn; the third largest, 6.6, was in oats; and the fourth largest, 5.9, was in rye. Last year the percentage for the four grains was 11.3.

TABLE 13.—*Round-lot and job-lot trading on Chicago Board of Trade, fiscal year 1939*

Grain	Total volume of trading	Round-lot trading		Job-lot trading	
	1,000 bushels	*1,000 bushels*	*Percent*	*1,000 bushels*	*Percent*
Wheat	4,372,121	3,902,274	89.3	469,847	10.7
Corn	1,493,893	1,341,383	89.8	152,510	10.2
Oats	270,785	252,917	93.4	17,868	6.6
Rye	116,548	109,711	94.1	6,837	5.9
Total	6,253,347	5,606,285	89.7	647,062	10.3

CONTRACTS SETTLED BY DELIVERY

As table 14 shows, 0.5 percent of all wheat futures contracts executed on the Chicago Board of Trade were settled by delivery of the actual wheat. Approximately the same percentage of other grain futures contracts on the larger markets were also settled by delivery.

TABLE 14.—*All grains: Total futures contracts settled by delivery on all contract markets, fiscal year 1939*

Market	Commodity	Total volume of trading during life of all futures maturing in fiscal year [1]	Volume of futures contracts settled by delivery	Percent
		1,000 bushels	*1,000 bushels*	
Chicago Board of Trade	Wheat	4,941,045	24,494	0.5
Chicago Open Board		122,044	1	[2]
Kansas City		548,303	4,145	.8
Minneapolis		359,533	1,483	.4
Duluth		41,962	682	1.6
Seattle		4,009	9	.2
Portland		152	0	0
Milwaukee		5,012	0	0
Chicago Board of Trade	Corn	1,450,607	26,459	1.8
Chicago Open Board		16,406	28	.2
Kansas City		40,806	635	1.6
Milwaukee		2,909	0	0
Minneapolis		23,429	133	.6
Chicago Board of Trade	Oats	207,591	1,865	.9
Chicago Open Board		839	0	0
Minneapolis		52,252	342	.7
Milwaukee		977	0	0
Kansas City		60	0	0
Chicago Board of Trade	Rye	77,922	2,959	3.8
Chicago Open Board		99	0	0
Minneapolis		47,110	1,072	2.3
Duluth		71	27	38.0
Milwaukee		356	0	0
Minneapolis	Barley	10,130	660	6.5
Los Angeles		20	16	80.0
Minneapolis	Flaxseed	11,600	592	5.1
Duluth		62	2	3.2

[1] These totals are not comparable with those of the volume of trading during the fiscal year inasmuch as trading began approximately 10 months before delivery month and consequently covers a different period than the fiscal year.

[2] Less than 0.01 percent.

This very small percentage of futures contracts settled by delivery of the actual commodity does not indicate that futures contracts are not related to the actual commodities. Tables 6 and 8 show that a very high proportion of the short positions and an appreciable percentage of the long commitments in the market are hedges of the actual commodity. It is to the advantage of the grain producer, dealer, and processor that futures contracts can be closed out by offset. Most dealers prefer to contract for specific qualities to meet their individual needs. As long as deliveries can be made easily and economically they are likely to be a small proportion of the total volume of futures transactions. In the larger futures markets it is only when manipulation, squeezes, or congestion make delivery difficult that any considerable percentage of futures contracts are settled by delivery.

Of the total amount of wheat delivered in settlement of futures contracts, 7,766,000 bushels, or 94 percent, was No. 2 Yellow Hard Winter; 253,000 bushels, or 3 percent, No. 2 Hard Winter; and 234,000 bushels, or 3 percent, No. 2 Red Winter. These totals as well as those for other grains are shown in table 15.

TABLE 15.—*Grades of wheat, corn, oats, and rye delivered on Chicago Board of Trade, by futures, fiscal year 1939*

[In thousands of bushels, i. e., 000 omitted]

Future	Wheat				Corn				Oats			Rye
	No. 2 Red Winter	No. 2 Yellow Hard Winter	No. 2 Hard Winter	Total	No. 2 Yellow	No. 2 White	No. 2 Mixed	Total	No. 2 White	No. 3 White	Total	No. 2
1938												
July	231	125	0	356	1,172	318	10	1,500	57	20	77	5
September	3	3,942	0	3,945	628	132	40	800	0	425	425	90
December	0	2,671	0	2,671	2,815	0	140	2,955	585	0	585	505
1939												
May	0	1,028	253	1,281	4,912	0	101	5,013	75	65	140	745
Total	234	7,766	253	8,253	9,527	450	291	10,268	717	510	1,227	1,345

WHEAT PRICES

During the year wheat futures prices were at the lowest levels recorded since 1932–33. Table 16 lists the average price per bushel of the dominant future on the Chicago Board of Trade for the last 10 years. Prices reached a post-depression high of $1.37⅝ in March 1937 and declined almost continuously from that date to October 1938 when a low level of 65 cents was recorded. At no time during the year did the monthly average exceed 75 cents. The yearly average of 68½ cents, was 28 percent below the 1938 average, 94½ cents, and 43 percent below the 1937 average, $1.20.

TABLE 16.—*Average price per bushel of the dominant wheat future on the Chicago Board of Trade, fiscal years 1930–39*

[In cents per bushel]

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
1929–30	136¾	143⅞	139⅛	130½	132¾	134¼	128⅜	117½	110	109¾	104⅝	101¾	124⅛
1930–31	91	95	85⅜	79⅛	78½	80⅞	82¼	82⅛	81¾	62⅜	61⅜	58¼	78⅛
1931–32	53½	52½	49⅛	51¾	64⅛	56⅞	58	60¼	57⅝	59¾	57¾	52⅝	56⅛
1932–33	49½	55¾	54⅞	48⅝	48⅜	46¾	47¾	47⅜	51⅝	63	72¾	80¾	55⅝
1933–34	103⅛	95½	90¾	84	90¼	85⅛	88⅜	89⅞	87½	81⅜	87	95½	89⅝
1934–35	96⅛	106	104¾	98	98½	100½	98⅛	96¾	94½	96¾	92	82¼	97
1935–36	85¾	90¾	96	102⅜	97¼	97⅞	101	99	98½	88¼	85¾	86⅝	94⅜
1936–37	104⅞	111¼	112¼	114⅞	114⅝	128⅛	131⅛	133¼	137⅝	122⅜	118⅛	111½	120
1937–38	122⅝	111	106½	100	90¾	92	95⅜	94⅛	88⅛	80⅞	76¼	76½	94½
1938–39	70⅞	65¾	64⅝	65	65⅜	67⅛	69½	68¼	68	68½	74¾	73⅜	68½

CORN PRICES

Corn futures prices were at low levels during the entire year. The average price per bushel of the dominant future on the Chicago Board of Trade (table 17) was 50¾ cents for the year, a decline of 21 percent from the 64¼-cent average for 1938 and a decline of 51 percent from the $1.03½ average for 1937. Prices reached a post-depression average high of $1.19⅝ in May 1937 and then declined precipitately. The 45½-cent average for October 1938 was the post-depression low.

TABLE 17.—*Average price per bushel of the dominant corn future on the Chicago Board of Trade, fiscal years 1929–39*

[In cents per bushel]

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
1929–30	101⅛	97½	99⅛	95¾	95¾	96½	93⅜	89¾	83⅜	85½	80¼	77⅝	91⅛
1930–31	79¼	92	83⅞	70⅝	77⅝	74⅜	69¼	65¼	63¾	61½	58	54⅜	71⅞
1931–32	52½	39¾	37¾	33⅜	47¾	41	40⅞	39⅞	33⅜	36⅝	32½	31¾	39⅝
1932–33	32⅛	32⅞	30⅜	25⅞	29¾	27⅛	26⅞	25½	27¾	35¾	44¾	50½	32½
1933–34	62⅛	56¾	52⅜	44	52⅛	51⅜	52⅜	51½	50¾	48⅝	51¼	58⅞	52¾
1934–35	62¾	78⅜	78⅜	75⅞	83⅜	89¼	87⅛	84⅞	79¾	81¾	81¼	75⅛	79⅞
1935–36	75⅝	57⅞	57½	60¾	59⅜	59½	60⅜	60⅞	60⅛	60¾	60½	60⅞	61¼
1936–37	84⅜	95¾	94⅞	94½	96⅛	104⅝	109¾	107¾	111⅛	118¼	119⅝	104¾	103½
1937–38	107	65⅞	63¾	59½	57½	59	61	59⅛	59⅝	61¼	58¼	58½	64¼
1938–39	59	49⅞	50	45½	50½	52¼	52¼	49⅜	48⅛	49⅝	51⅛	50⅞	50¾

COTTON

During the 10-year period 1929–38 cotton produced in the United States had an average annual farm value of $673,455,000. It is estimated that one-third of all farms in the United States produce cotton and that there are over 10,000,000 people whose livelihood is primarily dependent upon its production, distribution, or manufacture. Since practically the entire crop is sold at prices based on futures prices quoted on one of the important cotton futures exchanges, the transactions taking place on those exchanges are therefore of vital interest in the economic life of the United States.

The New York Cotton Exchange, the New Orleans Cotton Exchange, and the Chicago Board of Trade have been designated contract markets under the Commodity Exchange Act and authorized to conduct trading in cotton futures. Those markets have four major functions: (1) They furnish hedging or price-insuring facilities, (2) they aid in price determination, (3) they furnish a continuous market, and (4) they aid in the handling of the heavy after-harvest movement.

Prior to the enactment of the Commodity Exchange Act amendments of June 15, 1936, there were no statistics currently published relating to the transactions on the cotton futures markets. The New York and New Orleans offices of the Administration now release daily a statement of the total volume of trading and open contracts as reported by clearing association members. Each month a summary of those figures is issued. Every week a statement is published giving the amount of unfixed call sales and purchases. And at the end of each year detailed information is published covering all of those items as well as numerous others.

VOLUME OF TRADING

A decline of 19.4 percent in the volume of cotton futures transactions from the previous year was recorded for 1939. As shown in table 18, transactions totaled 38,454,000 bales as compared with 47,729,000 bales for 1938. The 1939 total was, moreover, only 52.5 percent of the annual average total of 73,225,000 bales for the 10-year period 1929–38 and, with the exception of the fiscal year 1936, was the lowest on record.

Eighty-four percent of the total volume of trading, involving 32,304,000 bales, took place on the New York Cotton Exchange; 15.6 percent, involving 6,009,000 bales, on the New Orleans Cotton Exchange; and 0.4 percent, involving 141,000 bales, on the Chicago Board of Trade.

TABLE 18.—*Cotton: Annual volume of trading on contract markets, fiscal years 1929–39* [1]

[In thousands of bales, i. e., 000 omitted]

Year	New York	New Orleans	Chicago	Total	Year	New York	New Orleans	Chicago	Total
1929	99,494	37,323	1,074	137,891	1936	30,688	6,371	411	37,470
1930	71,918	33,252	691	105,861	1937	43,925	9,989	1,038	54,952
1931	52,766	20,536	177	73,479	1938	39,334	8,109	286	47,729
1932	50,179	16,453	662	67,294					
1933	56,096	18,500	1,926	76,522	Average	54,052	18,188	985	73,225
1934	57,252	20,573	2,460	80,285					
1935	38,864	10,776	1,128	50,768	1939	32,304	6,009	141	38,454

[1] Pass-outs, or trades made by floor traders in which both the purchase and sale are made on the same day at the same price, and not cleared, are included in volume of trading beginning in November 1937.

OPEN CONTRACTS

The level of open contracts on all markets combined declined from a daily average of 3,232,000 bales in 1938 to 2,444,000 bales in 1939, a drop of 24 percent (table 19). While this decline appears to be large, the volume of open contracts tends to parallel commercial stocks of cotton, and free commercial stocks during the year were only approximately 68 percent of similar stocks in 1938. The decline in the volume of open contracts therefore has been less than the decline in free commercial stocks of cotton.

TABLE 19.—*Cotton: Maximum, minimum, and average daily open contracts, by contract markets, fiscal years 1938 and 1939*

[In thousands of bales, i. e., 000 omitted]

Fiscal year	New York			New Orleans			Chicago			Total		
	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average
1938 [1]	3,303	2,140	2,790	555	347	433	12	5	9	3,824	2,530	3,232
1939	2,679	1,321	2,087	458	205	351	12	1	6	3,141	1,530	2,444

[1] 9 months—October 1937 through June 1938.

SPECIAL ACCOUNTS

Traders having a position in any cotton future of 5,000 bales or more are required to make daily reports of their positions and transactions in all futures and markets to the Administration. There were 100 cotton traders who at some time during the year made such reports. A classification of the positions so reported on the New York Cotton Exchange, and the estimated holdings of traders not subject to the reporting requirement are shown in table 20.

TABLE 20.—*Cotton, all futures on New York Cotton Exchange: Average daily total commitments of reporting traders classified according to purpose and estimated total commitments of traders not subject to reporting requirement, fiscal year 1939*

[In thousands of bales, i. e., 000 omitted]

Year and Month	Total open contracts [1]	Small traders (estimated) [2]		Traders subject to 5,000-bale reporting requirement reported as—						Total	
				Speculative		Hedging		Straddling			
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938											
July	2,071	1,723	899	40	1	233	1,104	75	67	348	1,172
August	2,115	1,767	957	30	4	253	1,058	65	96	348	1,158
September	2,279	1,861	966	46	9	288	1,204	84	100	418	1,313
October	2,472	2,002	923	92	1	319	1,464	59	84	470	1,549
November	2,643	2,070	947	123	2	369	1,590	81	104	573	1,696
December	2,555	2,031	908	96	1	354	1,534	74	112	524	1,647
1939											
January	2,459	1,938	871	97	1	353	1,448	71	139	521	1,588
February	2,293	1,802	860	65	12	336	1,259	90	162	491	1,433
March	1,925	1,567	761	72	6	239	1,017	47	141	358	1,164
April	1,644	1,276	653	59	6	242	890	67	95	368	991
May [3]	1,364	1,052	565	52	4	156	719	104	76	312	799
June [3]	1,352	937	541	78	2	206	705	131	104	415	811
Average [4]	2,087	1,661	819	70	4	277	1,158	79	106	426	1,268

[1] See description of method of compiling these figures in section on "Open contracts."
[2] See footnote, p. 5.
[3] Preliminary data.
[4] Average for year (298 trading days).

The composition of the cotton futures market is similar to that of the grain market, but speculative positions by large traders play a somewhat less important role in cotton. The predominance of long over short speculative positions among large traders is even more pronounced, the proportions being 17 to 1. Straddling by large traders on the New York Cotton Exchange is a less significant part of their total trading than spreading operations are for large grain traders on the Chicago Board of Trade. Straddles in cotton futures at New York by large traders represented on an average 79,000 bales, or 3.8 percent, of all long commitments and 106,000 bales, or 5.1 percent, of all short commitments. Spreading of large traders at Chicago was 10.2 percent of the total for both long and short commitments.

Traders who were not required to report accounted for about 80 percent of all long positions in the market and approximately 40 percent of the short positions. No information is available as to the classification of these small positions, whether hedging, straddling, or open speculation.

TRADING IN FOREIGN MARKETS

In addition to the American cotton futures markets in New York, New Orleans, and Chicago important cotton futures markets are also conducted at Liverpool, Alexandria, Bombay, and Havre. Many American firms and individuals trade on these foreign markets, and likewise many foreign business houses and individuals trade on American markets.

All firms and individuals in special account status (i. e., having long or short 5,000 bales or more in one future in an American contract market) are required to report all their transactions in both domestic and foreign markets daily to the Administration. Tables 21 and 22 show the positions held by Americans in foreign and domestic markets during the past year. Speculation by these traders in foreign markets was negligible, but short hedges abroad averaged 324,000 bales through the year. This was about one-fourth as great as their aggregate hedges in American markets. Their straddle commitments, long and short combined, in foreign markets were about one-third of their straddle commitments in domestic markets. The most common straddle between a domestic and a foreign market was short in this country and long in the foreign market.

TABLE 21.—*Cotton futures: Average daily total commitments of reporting traders in domestic and foreign markets classified according to purpose, fiscal year 1939*

[In thousands of bales, i. e., 000 omitted]

Year and month	Total commitments in domestic markets reported as—							
	Speculative		Hedging		Straddling		Total	
	Long	Short	Long	Short	Long	Short	Long	Short
1938								
July	45	2	238	1,252	119	123	402	1,377
August	30	14	260	1,204	110	146	400	1,364
September	46	13	304	1,357	122	140	472	1,510
October	99	1	329	1,678	86	99	514	1,778
November	131	2	394	1,810	113	133	638	1,945
December	102	1	385	1,740	117	146	604	1,887
1939								
January	98	6	389	1,631	122	177	609	1,814
February	69	30	377	1,414	125	194	571	1,638
March	73	38	280	1,100	75	154	428	1,292
April	59	32	274	954	89	122	422	1,108
May [1]	55	11	189	706	133	120	377	897
June [1]	78	3	238	753	168	142	484	898
Average [2]	73	13	302	1,295	115	141	490	1,449

[1] Preliminary data.
[2] Average for year (298 trading days).

TABLE 21.—*Cotton futures: Average daily total commitments of reporting traders in domestic and foreign markets classified according to purpose, fiscal year 1939*—Continued

Year and month	Total commitments in foreign markets reported as—								Total commitments in all markets	
	Speculative		Hedging		Straddling		Total			
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938										
July			6	330	24	20	30	350	432	1,727
August			11	299	44	8	55	307	455	1,671
September		1	13	312	36	18	49	331	521	1,841
October			6	373	34	21	40	394	554	2,172
November			11	431	42	22	53	453	691	2,398
December		1	16	437	55	26	71	464	675	2,351
1939										
January		1	27	425	79	24	106	450	715	2,264
February			29	398	88	18	117	416	688	2,054
March		11	22	359	95	16	117	386	545	1,678
April		24	16	283	79	45	95	352	517	1,460
May [1]		8	24	179	45	58	69	245	446	1,142
June [1]			30	93	16	42	46	135	530	1,033
Average [2]		4	17	324	53	27	70	355	560	1,804

[1] Preliminary data.
[2] Average for year (298 trading days).

TABLE 22.—*Cotton: Proportion of futures positions held on the first of the month on United States and foreign markets, by class of position, 1938–39* [1]

Month	Domestic markets								Foreign markets							
	Speculative		Hedging		Straddling		Total		Speculative		Hedging		Straddling		Total	
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
July	14.4	0.3	48.8	72.2	33.9	7.5	97.1	80.0	0.0	0.0	1.0	18.6	1.9	1.4	2.9	20.0
Aug.	7.6	.2	55.0	72.7	25.4	7.8	89.0	80.7	.0	.0	1.7	18.6	9.3	.7	11.0	19.3
Sept.	6.6	1.3	57.7	72.6	23.2	8.9	87.5	81.9	.1	.0	3.9	17.6	8.5	.5	12.5	18.1
Oct.	14.0	.0	61.2	78.4	16.6	4.8	91.8	83.2	.0	.0	1.4	15.9	6.8	.9	8.2	16.8
Nov.	17.1	.1	60.2	75.8	15.6	5.2	92.9	81.1	.0	.0	1.5	17.9	5.6	1.0	7.1	18.9
Dec.	18.3	.0	57.2	75.1	15.6	5.4	91.1	80.5	.0	.0	1.9	18.6	7.0	.9	8.9	19.5
Jan.	15.2	.1	54.2	73.6	17.0	7.0	86.4	80.7	.0	.1	3.5	18.2	10.1	1.0	13.6	19.3
Feb.	10.4	.7	55.0	69.9	18.8	9.4	84.2	80.0	.0	.0	3.8	19.0	12.0	1.0	15.8	20.0
Mar.	12.5	2.0	52.3	68.2	15.6	9.1	80.4	79.3	.0	.0	5.2	20.3	14.4	.4	19.6	20.7
Apr.	13.7	1.8	53.5	66.0	13.1	8.9	80.3	76.7	.1	1.8	3.3	20.0	16.3	1.5	19.7	23.3
May	11.2	1.1	48.8	67.1	20.4	9.7	80.4	77.9	.0	1.3	4.5	16.8	15.1	4.0	19.6	22.1
June	21.3	.5	33.6	70.2	37.7	13.7	92.6	84.4	.0	.0	4.3	11.4	3.1	4.2	7.4	15.6

[1] Reports of traders holding 5,000 bales or over in a single future on the first of each month.

TRADING BY FOREIGN ACCOUNTS

Table 23 gives the total open contracts on the New York Cotton Exchange and the commitments reported by persons in the United States and abroad for each month during the year. Of an average total of 2,065,400 bales, foreign accounts held 72,709, or 3.5 percent, on the long side, and 38,500, or 1.9 percent, on the short side. Foreign speculators reported 36,800 bales on the long side and 1,700 bales on the short side. As was to be expected, 49 percent of the total long positions and 96 percent of the total short positions of all foreign accounts were hedging.

TABLE 23.—*Cotton: Total commitments reported by all persons subject to 5,000-bale reporting requirement on the New York Cotton Exchange, end of each month, fiscal year 1939*

[In thousands of bales, i. e., 000 omitted]

Date	Total open contracts	Total reported commitments		United States, reported as—								Foreign, reported as—							
				Speculative		Hedging		Straddling		Total		Speculative		Hedging		Straddling		Total	
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938																			
July 30	2,065.1	332.3	1,166.0	20.3	2.3	195.6	1,055.4	63.4	72.0	279.3	1,129.7	10.9	------	42.1	36.3	------	------	53.0	36.3
Aug. 31	2,140.5	332.0	1,145.9	14.3	------	211.3	994.6	65.8	100.1	291.4	1,094.7	11.5	------	29.1	51.2	------	------	40.6	51.2
Sept. 30	2,317.1	387.2	1,380.5	35.5	------	248.9	1,261.4	46.1	79.6	330.5	1,341.0	24.7	------	32.0	39.5	------	------	56.7	39.5
Oct. 31	2,637.4	578.6	1,675.4	58.6	1.8	338.3	1,527.6	86.1	110.3	483.0	1,639.7	45.2	------	50.4	35.7	------	------	95.6	35.7
Nov. 30	2,577.6	539.8	1,668.5	68.0	------	305.2	1,530.9	67.4	103.1	440.6	1,634.0	47.5	------	51.7	34.5	------	------	99.2	34.5
Dec. 30	2,517.1	511.1	1,642.7	51.5	------	287.0	1,479.8	69.0	123.6	407.5	1,603.4	49.4	------	54.2	39.3	------	------	103.6	39.3
1939																			
Jan. 31	2,398.8	527.0	1,513.6	32.7	------	314.2	1,311.9	84.7	161.1	431.6	1,473.0	47.9	5.1	47.5	35.5	------	------	95.4	40.6
Feb. 28	2,134.1	432.4	1,299.8	14.0	------	243.6	1,132.0	74.6	156.5	332.2	1,288.5	54.7	5.1	45.5	6.2	------	------	109.2	11.3
Mar. 31	1,791.1	366.9	1,071.5	19.8	3.2	216.3	941.5	43.7	121.0	279.8	1,075.7	53.8	------	33.3	5.8	------	------	87.1	5.8
Apr. 29	1,482.6	344.2	916.7	16.2	3.9	165.4	800.8	105.9	97.4	287.5	902.1	33.5	------	23.2	14.6	------	------	56.7	14.6
May 31	1,329.0	355.9	795.2	57.7	------	121.8	634.3	135.6	97.4	315.1	731.7	34.8	5.0	6.0	58.5	------	------	40.8	63.5
June 30	1,394.6	541.9	851.5	54.0	1.2	308.3	637.3	136.1	123.6	498.4	762.1	27.5	5.0	16.0	84.4	------	------	43.5	89.4
Average	2,065.4	437.4	1,260.6	36.9	1.0	246.3	1,109.0	81.5	112.1	364.7	1,222.1	36.8	1.7	35.9	36.8	------	------	72.7	38.5

These statistics indicate clearly that whatever slight influence the trading operations of foreign firms and individuals had in American markets was preponderantly on the long side.

SELLING COTTON ON CALL

Some 40 years ago certain mills requiring special qualities of cotton which too frequently became scarce and expensive, began to cover their spinning needs far in advance when conditions for supplying them seemed favorable. The custom developed whereby the price was not fixed outright, but the premium on a designated future was determined, the buyer having the privilege of selecting the time of price fixation. This practice came to be known as buying cotton on call.

Advocates of this system of trading on call claim that it is advantageous in that it enables a mill to cover its requirements in advance without assuming market risk, and that it is economical because mills can frequently avoid the expense of futures commissions and yet avoid market risk by fixing the price of their cotton purchases as they sell their products. It is also claimed that frequently dealers with limited capital are able to find customers willing to trade with them for forward shipments on call when their credit rating would prevent customers from doing so at fixed prices. Although this peculiar marketing device has not been applied generally to the marketing of other commodities, the major portion of cotton sold to mills is now on buyer's call.

With the expansion of selling on call, some abuses of this type of contract have developed. It has been charged these malpractices have frequently resulted in hardships to the industry, especially in connection with traders having a large volume of call sales on their books assuming similar positions in futures and thus manipulating the prices of certain futures, causing mills to have to fix their prices arbitrarily or transfer their calls forward at exorbitant differences. Others point out that the substitution of call sales for futures trades has threatened the futures system.

In an effort to protect the benefits of the call system and eliminate the abuses, the Administration began in May 1939 the weekly publication of certain call sales and purchase figures. The publication of these figures takes from any particular group any advantage which would accrue to them from a private knowledge of others' positions.

Table 24 shows unfixed call sales and call purchases outstanding on the books of merchants reporting to the Administration as of the first Friday of each month, July 1938 through June 1939. There is evidence of a seasonable pattern in these figures corresponding closely to the crop movement.

TABLE 24.—*Cotton: Unfixed call sales and purchases based on all futures of the New York Cotton Exchange, by weeks, fiscal year 1939* [1]

Date	Call sales		Call purchases		Date	Call sales		Call purchases	
	Reported unfixed	Change previous week	Reported unfixed	Change previous week		Reported unfixed	Change previous week	Reported unfixed	Change previous week
1938	*Bales*	*Bales*	*Bales*	*Bales*	*1939*	*Bales*	*Bales*	*Bales*	*Bales*
July 1	499,050		155,450		Jan. 6	1,043,750	+50,250	242,500	+5,350
8	452,450	−46,600	149,650	−5,800	13	1,027,100	−16,650	238,950	−3,550
15	479,700	+27,250	188,750	+39,100	20	1,047,750	+20,650	222,850	−16,100
22	512,000	+32,300	200,400	+11,650	27	1,023,600	−24,150	217,650	−5,200
29	533,200	+21,200	197,750	−2,650	Feb. 3	958,150	−65,450	206,650	−11,000
Aug. 5	612,450	+79,250	203,350	+5,600	10	930,350	−27,800	204,800	−1,850
12	637,050	+24,600	191,050	−12,300	17	900,300	−30,050	196,500	−8,300
19	687,750	+50,700	188,800	−2,250	24	868,500	−31,800	181,800	−14,700
26	770,550	+82,800	192,900	+4,100	Mar. 3	866,150	−2,350	178,200	−3,600
Sept. 2	845,500	+74,950	214,550	+21,650	10	825,600	−40,550	171,850	−6,350
9	836,250	−9,250	222,900	+8,350	17	765,400	−60,200	165,950	−5,900
16	834,100	−2,150	229,450	+6,550	24	732,800	−32,600	154,200	−11,750
23	784,100	−50,000	229,200	−250	31	702,300	−30,500	150,900	−3,300
30	820,700	+36,600	236,800	+7,600	Apr. 7	703,650	+1,350	149,900	−1,000
Oct. 7	855,300	+34,600	251,350	+14,550	14	697,400	−6,250	144,950	−4,950
14	927,450	+72,150	271,100	+19,750	21	643,000	−54,400	119,800	−25,150
21	1,045,250	+117,800	279,600	+8,500	28	602,650	−40,350	104,750	−15,050
28	1,070,700	+25,450	281,000	+1,400	May 5	570,400	−32,250	83,950	−20,800
Nov. 4	1,046,650	−24,050	277,100	−3,900	12	548,100	−22,300	77,100	−6,850
11	1,066,900	+20,250	264,100	−13,000	19	486,900	−61,200	58,300	−18,800
18	1,081,050	+14,150	272,850	+8,750	26	492,850	+5,950	58,150	−150
25	1,000,450	−80,600	245,450	−27,400	June 2	518,550	+25,700	61,300	+3,150
Dec. 2	972,100	−28,350	235,450	−10,000	9	588,100	+69,550	52,550	−8,750
9	936,150	−35,950	239,200	+3,750	16	731,650	+143,550	49,600	−2,950
16	948,600	+12,450	238,800	−400	23	832,900	+101,250	42,650	−6,950
23	979,250	+30,650	239,100	+300	30	922,450	+89,550	48,150	+5,500
30	993,500	+14,250	237,150	−1,950					

[1] Reported by merchants with futures contracts of 5,000 bales or over in a single future.

Further research is being done in the hope of further improvement of trading conditions.

CIRCULATION OF TRANSFERABLE NOTICES

Throughout the year the Administration collected data on the circulation of transferable delivery notices on the New York Cotton Exchange. Table 25 shows the number of transfers of notices of intent to deliver issued in settlement of futures contracts on the New York Cotton Exchange during the year. Of a total of 2,041 notices issued, 1,260, or 61.7 percent, were stopped without transfer; 19.1 percent of the notices were transferred once; 8.2 percent twice; and only 1 percent 10 times or over. The average number of transfers per notice was less than 1, amounting to 0.9. Of the 2,041 notices issued, 1,971, or 96.5 percent were transferred 5 times or less per notice. The maximum number of transfers shown was 18 and involved 2 notices.

TABLE 25.—*Cotton: Number of transfers*[1] *of notice issued in settlement of futures contracts on the New York Cotton Exchange, fiscal year 1939*

Times notice was transferred (number)	July 1938		October 1938		December 1938		January 1939	
	Notices	Transfers	Notices	Transfers	Notices	Transfers	Notices	Transfers
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
0	640	0	253	0	40	0	39	0
1	130	130	87	87	18	18	56	56
2	44	88	37	74	7	14	40	80
3	19	57	42	126	10	30	8	24
4	7	28	20	80	2	8	4	16
5	4	20	19	95	5	25		
6	1	6	15	90	6	36		
7	2	14	3	21	4	28		
8	1	8	9	72	2	16		
9			3	27	2	18		
10			3	30				
11			4	44				
12			3	36				
13			4	52				
14								
15			1	15				
16			1	16				
17								
18								
Total	848	351	504	865	96	193	147	176
Average		0.4		1.7		2.0		1.2

Times notice was transferred (number)	March 1939		May 1939		Total		
	Notices	Transfers	Notices	Transfers	Notices		Transfers
	Number	*Number*	*Number*	*Number*	*Number*	*Percent*	*Number*
0	166	0	122	0	1,260	61.7	0
1	64	64	35	35	390	19.1	390
2	26	52	14	28	168	8.2	336
3	3	9	4	12	86	4.2	258
4			2	8	35	1.7	140
5	1	5	3	15	32	1.6	160
6			1	6	23	1.1	138
7	1	7			10	.5	70
8					12	.6	96
9			1	9	6	.3	54
10			1	10	4	.2	40
11					4	.2	44
12					3	.1	36
13					4	.2	52
14							
15					1	.1	15
16					1	.1	16
17							
18	2	36			2	.1	36
Total	263	173	183	123	2,041	100.0	1,881
Average		0.7		0.7			0.9

[1] A transfer occurs when a notice of delivery is received by a long and then applied on a sale made on the same trading day either before or after receipt of the notice within a limited period prescribed by the rules of the exchange.

Many traders apparently are not aware of the small number of transfers per notice which have taken place during the year. This is indicative of settlement of futures contracts by delivery without excessive circulation of notices in the market. Furthermore, analysis of the notices that circulated indicates that the majority of traders liquidating long positions because of receipt of notices were speculators who either had losses or anticipated a last-minute price advance.

The majority of traders with open long positions do not desire delivery, and their orders in the market usually contain the phrase "sell on receipt of notice." In view of the practice of longs delaying liquidation, when the positions are closed out because of receipt of notices, the liquidating sales by longs, rather than the transferable feature of the notice, are the cause of price declines.

DELIVERIES

Of the 39,236,900 bales of cotton traded on all exchanges during the life of futures which matured during the year, 262,600 bales, or 0.7 percent, were settled by delivery of cotton. A large percentage of the total volume of futures trading involves the maintaining of positions for very short periods. Consequently, a comparison between total volume of trading and deliveries is not particularly instructive. A much more significant relationship is that between maximum open contracts and deliveries. The 262,600 bales delivered on futures contracts during the year amounted to 8 percent of the 3,148,000 maximum open contracts.

TABLE 26.—*Cotton: Total futures contracts settled by delivery on all contract markets, fiscal year 1939*

Market	Total volume of trading during life of all futures maturing in fiscal year [1]	Futures contracts settled by delivery [2]	
	Bales	*Bales*	*Percent*
New York Cotton Exchange	32,685,200	204,100	0.6
New Orleans Cotton Exchange	6,350,250	57,300	.9
Chicago Board of Trade	201,450	1,200	.6
Total	39,236,900	262,600	.7

[1] These totals are not comparable with those of the volume of trading during the fiscal year inasmuch as trading began approximately 10 months before delivery month and consequently covers a period different from the fiscal year. [2] 1 contract is equal to 100 bales.

Under both New York and New Orleans contracts the major portion delivered was 7/8-inch cotton. Table 27 shows the grades of cotton delivered on New York and New Orleans contracts. It will be noted that nearly 44 percent of the total amount delivered was Low Middling, 17 percent Strict Low Middling, and 16.8 percent Middling Spotted.

TABLE 27.—*Cotton: Grades delivered on New York and New Orleans Cotton Exchanges, all futures combined, fiscal year 1939*

Grade	New York				New Orelans				Total	Percent
	7/8 inch	15/16 inch	1 inch	Total	7/8 inch	15/16 inch	1 inch	Total		
Middling Fair	0	0	0	0	0	0	0	0	0	0.0
Strict Good Middling	2	0	0	2	1	1	13	15	17	(1)
Good Middling	168	13	0	181	101	9	0	110	291	.1
Strict Middling	5,699	613	125	6,437	1,900	186	190	2,276	8,713	3.4
Middling	9,089	1,037	1,146	11,272	1,467	410	253	2,130	13,402	5.3
Strict Low Middling	23,014	6,473	6,890	36,377	3,618	1,799	2,299	7,716	44,093	17.3
Low Middling	45,155	18,362	25,221	88,738	8,339	3,277	10,505	22,121	110,859	43.6
Good Middling Extra White	0	0	0	0	0	0	0	0	0	.0
Strict Middling Extra White	0	0	0	0	0	0	0	0	0	.0
Middling Extra White	2	3	0	5	51	1	0	52	57	(1)
Strict Low Middling Extra White	182	10	0	192	29	7	0	36	228	.1
Low Middling Extra White	239	42	23	304	481	14	3	498	802	.3
Good Middling Spotted	1,378	155	56	1,589	462	107	29	598	2,187	.9
Strict Middling Spotted	8,629	902	521	10,052	1,992	397	248	2,637	12,689	5.0
Middling Spotted	25,478	4,419	2,623	32,520	7,284	1,563	1,340	10,187	42,707	16.8
Good Middling Tinged	729	179	137	1,045	275	217	72	564	1,609	.6
Strict Middling Tinged	5,802	1,419	637	7,858	2,961	1,002	605	4,568	12,426	4.9
Good Middling Yellow Stained	279	288	284	851	247	272	393	912	1,763	.7
Good Middling, Gray	4	18	17	39	1	1	3	5	44	(1)
Strict Middling, Gray	165	358	930	1,453	23	155	933	1,111	2,564	1.0
Total	126,014	34,291	38,610	198,915	29,232	9,418	16,886	55,536	254,451	100.0

[1] Less than 0.1 percent

Houston leads as a delivery point in settlement of New York futures contracts with 45.8 percent, Mobile is second with 21.9, and New Orleans third with 11.5, as shown in table 28.

TABLE 28.—*Cotton: Distribution of cotton tendered in settlement of New York futures contracts by delivery point, fiscal year 1939*

Unit	New York	Norfolk	Charleston	Savannah	Mobile	New Orleans	Houston	Galveston	Total
Bales	0	5,776	1,588	16,561	43,501	22,851	91,150	17,488	198,915
Percent	0	2.9	0.8	8.3	21.9	11.5	45.8	8.8	100.0

PRICES

The average price per pound of the dominant cotton future on the New York Cotton Exchange from July 1929 through June 1939 is shown in table 29. The average for 1939 was 8.26 cents, 7 percent below the average for 1938, which was 8.92 cents, and 33 percent below that for 1937, when the average was 12.42 cents.

TABLE 29.—*Cotton: Average price per pound of the dominant future on the New York Cotton Exchange, 1929–39*

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
1929–30	18.62	18.83	18.93	18.34	17.32	17.40	17.38	15.78	15.19	16.28	14.72	13.43	16.85
1930–31	12.79	11.95	10.99	10.66	10.85	10.19	10.51	11.13	10.98	10.44	9.79	9.31	10.80
1931–32	9.42	7.48	6.63	6.27	6.33	6.29	6.75	6.91	6.78	6.23	5.91	5.40	6.70
1932–33	5.86	7.57	7.70	6.48	6.10	5.92	6.27	6.06	6.31	7.06	8.85	9.62	6.98
1933–34	10.87	9.83	9.67	9.43	9.83	10.12	11.14	12.09	12.08	11.73	11.47	12.24	10.88
1934–35	12.78	13.41	12.87	12.25	12.27	12.58	12.57	12.43	11.38	11.46	11.63	11.24	12.24
1935–36	11.60	10.93	10.47	10.90	11.60	11.33	11.00	10.83	10.97	11.06	10.37	11.23	11.02
1936–37	12.26	11.75	11.92	11.84	11.78	12.23	12.36	12.52	13.88	13.58	12.68	12.23	12.42
1937–38	12.17	10.07	8.74	8.15	7.82	8.16	8.53	8.90	8.86	8.77	8.54	8.34	8.92
1938–39	8.76	8.38	7.97	8.34	8.59	8.28	8.14	8.10	8.25	7.88	7.93	8.48	8.26

BUTTER

VOLUME OF TRADING

Trading in butter futures was started on the Chicago Mercantile Exchange in 1919 and on the New York Mercantile Exchange in 1924. While there was a substantial increase in activity on the Chicago Mercantile Exchange until 1936–37, the volume of trading on the New York Mercantile Exchange has always been of negligible proportions and ceased entirely in 1938–39. On December 16, 1938, the New York Mercantile Exchange formally suspended futures trading in butter. At the close of the fiscal year, however, exchange officials were canvassing the sentiment of the members with respect to the adoption by the exchange of new official standards and the resumption of futures trading.

As in other futures markets, trading on the Chicago Mercantile Exchange declined during 1939 to 8,162 carlots, less than half of the 1938 total of 17,283 carlots and only 35 percent of the 5-year (1934–38) average of 23,345 carlots, as shown in table 30.

TABLE 30.—*Butter: Annual volume of trading by contract markets, fiscal years 1934–39*

Contract market	1934	1935	1936	1937	1938	5-year average	1939
	Carlots	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*
Chicago Mercantile Exchange	24,792	22,748	25,333	26,277	17,283	23,287	8,162
New York Mercantile Exchange	3	6	205	71	4	58	0
Total	24,795	22,754	25,538	26,348	17,287	23,345	8,162

It is estimated that futures trading in butter during the year had an approximate value of $39,037,000, a decline of 61 percent from the $99,245,000 estimated total for 1938.

There are several explanations for this marked decline in the volume of futures trading. Production was exceedingly high, the estimated production of creamery butter from January through May 1939 totaling 728,000,000 pounds, an increase of 3 percent over the 706,000,000 total for the same period during 1938. Stocks of creamery butter in cold storage aggregated 85,000,000 pounds on June 1, 1939, as compared with 55,000,000 in 1938 and the 5-year (1934–38) average of only 32,000,000. A factor of special significance has been the purchase of butter for relief purposes by governmental agencies and the holdings of those agencies. Those holdings had risen to 111,000,000 pounds in November 1938 but have since been materially reduced. Perhaps the most important cause of the decline in the volume of futures transactions was the relatively low price. The wholesale price of 92-score butter at New York averaged 25.68 cents during the year. This figure compares with a 1938 average of 27.97 cents and a 1937 average of 34.39 cents. The studies made by the Administration show that there is a strong tendency for trading to decline when prices are low.

OPEN CONTRACTS

Table 31 reveals a sharp decline of nearly 50 percent in the average daily open contracts from 1,175 carlots in 1937 to 651 carlots in 1939. This record would appear to support the conclusion that the futures market had been declining as a hedging market.

TABLE 31.—*Butter: Maximum, minimum, and average daily open contracts on Chicago Mercantile Exchange, fiscal years 1933–39*

Volume	1933	1934	1935	1936	1937	1938	1939
	Carlots	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*
Maximum	1,133	2,040	1,903	2,014	1,986	1,594	1,707
Minimum	211	108	165	93	301	208	61
Average	690	887	1,006	1,098	1,175	910	651

A definitely seasonal pattern, with open contracts declining steadily from a high of 1,570 carlots in August, when cold storage stocks were near a maximum, to a low of 122 carlots in February, when stocks in cold storage were low, is shown by the following figures of average daily open contracts each month: July, 1,541; August, 1,570; September, 1,233; October, 1,031; November, 643; December, 271; January, 165; February, 122; March, 126; April, 211; May, 351; June, 732.

SPECIAL ACCOUNTS

The volume of open contracts in butter futures after reaching a peak in midsummer falls off precipitately so that few reports from large traders were received from December to May (table 32). The reporting requirement is 25 carlots (480,000 pounds). Under this requirement 32 traders made reports to the Administration of their positions at some time during the year. In the active trading months short hedges of reporting traders declined from a daily average of 1,314 carlots in July to 303 carlots in November. This was over 85 percent of the total short position in July and somewhat less than 50 percent in November, when open contracts had declined greatly. No spreading positions and relatively few speculative positions were reported by large traders in butter.

TABLE 32.—*Butter, all futures on Chicago Mercantile Exchange: Average daily total commitments of reporting traders classified according to purpose and estimated total commitments of traders not subject to reporting requirement, fiscal year 1939*

Year and month	Total open contracts[1]	Small traders (estimated)[2]		Traders subject to 25-carlot reporting requirement reported as—							
		Long	Short	Speculative		Hedging		Spreading		Total	
				Long	Short	Long	Short	Long	Short	Long	Short
1938	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*
July	1,542	1,159	214	154	14	229	1,314	------	------	383	1,328
August	1,570	1,172	269	155	23	243	1,278	------	------	398	1,301
September	1,233	841	398	134	8	258	827	------	------	392	835
October	1,031	696	397	91	6	244	628	------	------	335	634
November	643	453	340	16	------	174	303	------	------	190	303
December	271	271	237	------	------	------	34	------	------	------	34
1939											
January	165	165	165	------	------	------	------	------	------	------	------
February	122	122	122	------	------	------	------	------	------	------	------
March	126	109	126	17	------	------	------	------	------	17	------
April	211	162	211	49	------	------	------	------	------	49	------
May[3]	351	259	318	80	9	12	24	------	------	92	33
June[3]	732	506	376	90	17	136	339	------	------	226	356
Average[4]	651	482	265	64	7	105	379	------	------	169	386

[1] See description of method of compiling these figures in section on "Open contracts."
[2] See footnote, p. 5.
[3] Preliminary data.
[4] Average for year (293 trading days).

DELIVERIES

Deliveries of butter in settlement of futures contracts on the Chicago Mercantile Exchange are shown in table 33. The percentage approximates deliveries of other minor commodities.

TABLE 33.—*Butter: Total futures contracts settled by delivery on the Chicago Mercantile Exchange, fiscal year 1939*

Futures	Total volume of trading during life of futures maturing in fiscal year[1]	Futures contracts settled by delivery		Futures	Total volume of trading during life of futures maturing in fiscal year[1]	Futures contracts settled by delivery	
1938	*Carlots*	*Carlots*	*Percent*	1939	*Carlots*	*Carlots*	*Percent*
November	7,182	190	2.6	January	486	27	5.6
December	974	43	4.4	February	325	9	2.8
				March	7	0	0.0
				May	20	5	25.0
				Total	8,994	274	3.0

[1] This total is not comparable with that of the volume of trading during the fiscal year inasmuch as trading began approximately 10 months before delivery month and consequently covers a different period than the fiscal year.

EGGS

VOLUME OF TRADING

Trading in egg futures aggregated 43,909 carlots of 400 cases each, a decline of 8.1 percent from the 47,792-carlot total for 1938 but 2.1 percent above the 5-year average of 42,996 carlots. As shown in table 34, 42,503 carlots, or 97 percent, were traded on the Chicago Mercantile Exchange and 1,406, or 3 percent, on the New York Mercantile Exchange.

TABLE 34.—*Eggs: Annual volume of trading by contract markets, fiscal years 1934–39*

Contract market	1934	1935	1936	1937	1938	5-year average	1939
	Carlots	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*
Chicago Mercantile Exchange	44,030	39,226	29,561	40,353	44,538	39,542	42,503
New York Mercantile Exchange	2,563	2,628	5,230	3,593	3,254	3,454	1,406
Total	46,593	41,854	34,791	43,946	47,792	42,996	43,909

It is estimated that egg futures transactions during 1939 had an approximate value of $107,400,000, a decline of 12 percent from the $118,000,000 total for 1938.

When basic supply and demand conditions are considered, the decline in the volume of trading is understandable. Production has been slightly above that of last year, which was a near-record year, and cold-storage holdings were exceptionally large. Large Government purchases for relief purposes tended to prevent a further decline in prices. These factors reduced the incentive to hedge and discouraged speculation.

OPEN CONTRACTS

The volume of open contracts, maximum, minimum, and daily average, for the fiscal years 1934 to 1939, is shown in table 35. The daily average of open contracts on the Chicago Mercantile Exchange has increased steadily from 1,347 carlots in 1936 to 2,459 carlots in 1939. While the data available are insufficient to justify any definite conclusion, it would appear from the steady rise year after year in the average open contracts that the egg futures market is being used more frequently and consistently for hedging purposes.

TABLE 35.—*Eggs: Maximum, minimum, and average daily open contracts, by contract markets, fiscal years 1934–39*

Fiscal year	Chicago Mercantile Exchange			New York Mercantile Exchange		
	Maximum	Minimum	Average	Maximum	Minimum	Average
	Carlots	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*
1934	3,933	185	1,829	----------	----------	----------
1935	2,962	351	1,680	----------	----------	----------
1936	2,564	187	1,347	----------	[1]	----------
1937	2,680	310	1,624	----------	----------	----------
1938	3,284	252	1,927	240	0	105
1939	4,301	494	2,459	141	0	67

[1] Open contracts not available on New York Mercantile Exchange from 1934 to 1937.

SPECIAL ACCOUNTS

The egg futures market presents in a striking manner the contrast between the large traders reporting positions and small traders who are not required to report their positions. The reporting requirement applies to all persons having a position, long or short, of 25 carlots or more in any egg future. During the fiscal year 1939, 76 individuals or firms at some time filed reports in accordance with this requirement. The positions they reported on the Chicago Mercantile Exchange were mainly short hedges. These short hedges amounted on the average to 1,746 carlots. Small traders held long positions almost exactly balancing this, or about 1,800 carlots.

During the year large speculative positions were predominantly on the long side for eggs as for most regulated commodities. Large traders held total long speculative positions averaging 469 carlots as compared with short speculative positions of 132 carlots. The reported commitments were primarily held on the Chicago Mercantile Exchange, with occasional positions reported on the New York Mercantile Exchange. There is no foreign market on which trading in egg futures is conducted.

The total open contracts and average daily total commitments of reporting traders are shown in table 36.

TABLE 36.—*Eggs, all futures on Chicago Mercantile Exchange: Average daily total commitments of reporting traders classified according to purpose and estimated total commitments of traders not subject to reporting requirement, fiscal year 1939*

Year and month	Total open contracts [1]	Small traders (estimated) [2]		Traders subject to 25-carlot reporting requirement reported as—							
		Long	Short	Speculative		Hedging		Spreading		Total	
				Long	Short	Long	Short	Long	Short	Long	Short
1938	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*
July	3,421	2,368	325	860	60	193	3,036	------	------	1,053	3,096
August	3,640	2,468	426	957	* 68	215	3,146	------	------	1,172	3,214
September	3,947	2,430	508	1,116	115	313	3,236	88	88	1,517	3,439
October	3,896	2,377	560	622	160	255	2,534	642	642	1,519	3,336
November	2,521	1,974	614	517	215	23	1,685	7	7	547	1,907
December	1,442	1,231	466	164	125	47	851	------	------	211	976
1939											
January	631	595	501	34	91	------	37	2	2	36	130
February	667	568	481	58	101	7	51	34	34	99	186
March	939	850	581	52	173	------	148	37	37	89	358
April	1,875	1,484	529	286	250	27	1,018	78	78	391	1,346
May [3]	2,946	2,401	504	397	152	88	2,230	60	60	545	2,442
June [3]	3,713	2,917	485	674	68	118	3,156	4	4	796	3,228
Average [4]	2,459	1,803	500	469	132	106	1,746	81	81	656	1,959

[1] See description of method of compiling these figures in section on "Open contracts."
[2] See footnote, p. 5.
[3] Preliminary data.
[4] Average for year (293 trading days).

DELIVERIES

Table 37 reveals that of the 44,893 carlots, the total volume of trading during the life of futures maturing during the year, 2,291 carlots, or 5.1 percent, were settled by delivery. It will be recalled that this percentage is approximately 10 times as large as the percentage of wheat futures contracts settled by delivery. There are several substantial reasons for this difference. In the first place, it is estimated that two-thirds of the trading in egg futures is done by persons or firms in the trade whereas the percentage of total wheat traders who are in the wheat trade is substantially smaller. Naturally, those members of the trade who held short positions would not have the same disinclination to accept delivery as traders who had no connection with the trade.

TABLE 37.—*Eggs: Total futures contracts settled by delivery on the Chicago Mercantile Exchange, fiscal year 1939*

Futures	Total volume of trading during life of futures maturing in fiscal year [1]	Futures contracts settled by delivery		Futures	Total volume of trading during life of futures maturing in fiscal year [1]	Futures contracts settled by delivery	
1938	*Carlots*	*Carlots*	*Percent*	1939	*Carlots*	*Carlots*	*Percent*
October	19,498	997	5.1	March	339	99	29.2
November	9,539	173	1.8	April	275	144	52.4
December	9,816	469	4.8	May	295	150	50.8
1939				June	166	65	39.2
January	4,126	167	4.0	Total	44,893	2,291	5.1
February	839	27	3.2				

[1] This total is not comparable with that of the volume of trading during the fiscal year inasmuch as trading began approximately 10 months before delivery month and consequently covers a different period than the fiscal year.

Another important difference is that wheat may be held in an elevator for several years although there is some deterioration with increasing age. In contrast to that situation the quality of eggs deteriorates comparatively rapidly so that the eggs must be merchandized at least during the winter after they are put in storage. Consequently, if the eggs are hard to merchandise an increased proportion is likely to be delivered on futures contracts.

The third reason deliveries on egg futures contracts are much greater than those on wheat futures contracts is that nearly three-fourths of all wheat futures trading is either scalping or in-and-out trading whereas the percentage in egg futures trading is estimated to be only a fraction of that amount. Scalping is trading by a professional for himself, on very small price fluctuations ordinarily closing the day with an even or near even position. In-and-out trading is speculation for quick profits. Both types of trading swell the total volume but neither culminates in deliveries.

POTATOES

Trading in potato futures was begun on the Chicago Mercantile Exchange in 1931. For a number of years prior to that time potato prices had been fluctuating frequently and severely. It was believed by those who favored the establishment of this market that by furnishing a futures market where supply and demand factors could be focused and where producers, dealers, and processors could hedge their actual commitments, there would be less violent price movements.

The potato futures market has not expanded as its sponsors had hoped. The volume of trading has been highly sporadic, advancing from a low level of 256 carlots in 1935–36, to 6,086 carlots in 1936–37 and then declining to 259 carlots in 1937–38. The total volume of trading for the past year, 231 carlots, is the lowest since trading began.

Concurrently with this record-low volume of futures transactions, prices have also been low. There is no evidence that futures trading has been responsible for the low prices; in fact, the volume of futures trading in potatoes is so slight compared with the total volume of potatoes marketed that it seems to have little if any effect upon the price received by the producer.

Tables 38 and 39 show the maximum, minimum, and average daily open contracts on the Chicago Mercantile Exchange and the total futures contracts settled by delivery. Inasmuch as the potato futures market is so thin that it has little value as a source of continuous price quotations or for hedging purposes, its present economic value is questionable.

TABLE 38.—*Potatoes: Maximum, minimum, and average daily open contracts on the Chicago Mercantile Exchange, fiscal years 1934–39*

Year	Maximum	Minimum	Average	Year	Maximum	Minimum	Average
	Carlots	*Carlots*	*Carlots*		*Carlots*	*Carlots*	*Carlots*
1933–34	130	0	27	1936–37	460	14	237
1934–35	104	1	20	1937–38	83	0	29
1935–36	57	0	16	1938–39	34	0	16

The reporting requirement for potato futures is 25 carlots, but interest in potato futures in the fiscal year 1939 was so small that no reports were received.

Table 39 shows the total futures contracts settled by delivery on the Chicago Mercantile Exchange during the year.

TABLE 39.—*Potatoes: Total futures contracts settled by delivery on the Chicago Mercantile Exchange, fiscal year 1939*

Item	November 1938	January 1939	March 1939	April 1939	May 1939	Total
Total volume of trading during life of all futures maturing in fiscal year [1]	*Carlots* 60	*Carlots* 66	*Carlots* 49	*Carlots* 35	*Carlots* 31	*Carlots* 241
Futures contracts settled by delivery	13	11	14	3	7	48
	Percent 21.7	*Percent* 16.7	*Percent* 28.6	*Percent* 8.6	*Percent* 22.6	*Percent* 19.9

[1] This total is not comparable with that of the volume of trading during the fiscal year inasmuch as trading began approximately 10 months before delivery month and consequently covers a period different from the fiscal year.

MILLFEEDS

Trading in millfeed futures is conducted on the Kansas City Board of Trade and the St. Louis Merchants' Exchange. Fifty-two percent of the trading was conducted on the Kansas City Board of Trade and 48 percent on the St. Louis Merchants' Exchange. As shown in table 40, there are two separate contracts, one of which provides for St. Louis delivery and the other for delivery in Chicago. Deliveries under the St. Louis contract are made in Chicago and St. Louis, but only 9 percent of the trading was for St. Louis delivery.

TABLE 40.—*Millfeeds: Total futures contracts settled by delivery, by contract markets, fiscal year 1939*

Market	Total volume of trading during life of all futures maturing in fiscal year [1]	Futures contracts settled by delivery	
	Tons	*Tons*	*Percent*
Kansas City Board of Trade	247,150	11,125	4.50
St. Louis Merchants' Exchange:			
St. Louis delivery	20,575	975	4.74
Chicago delivery	210,300	4,100	1.95
Total	478,025	16,200	3.39

[1] This total is not comparable with that of the volume of trading during the fiscal year inasmuch as trading began approximately 10 months before delivery month and consequently covers a period different from the fiscal year.

Millfeeds are a byproduct of the commercial milling of wheat flour and are used for feeding livestock. Futures trading is conducted in wheat bran and gray shorts. Wheat bran is the coarse outer covering of the wheat kernel as separated from cleaned and scoured wheat in the usual process of commercial milling. Gray shorts consist of the fine particles of the outer bran, the inner bran, the germ, and the offal or fibrous materials obtained from the tail of the mill.

Millfeeds shares with wool tops the distinction of being the only commodity included in the act which recorded an increase in volume of futures trading during the year. As shown in table 41, trading during 1939 aggregated 480,300 tons, an increase of 7 percent over the 446,950-ton total for 1938 but a decline of nearly 12 percent from the 544,590-ton average total for the 5-year period 1934–1938.

TABLE 41.—*Millfeeds: Annual volume of trading on contract markets, fiscal years 1934–39*

Market	1934	1935	1936	1937	1938	5 year average	1939
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Kansas City Board of Trade	228,700	256,625	160,175	352,025	166,275	232,760	254,200
St. Louis Merchants' Exchange:							
St Louis delivery	175,825	85,475	45,050	75,375	50.025	86,350	19,800
Chicago delivery	191,650	236,700	235,150	233,250	230,650	225,480	206,300
Total	596,175	578,800	440,375	660,650	446,950	544,590	480,300

Futures trading is utilized by flour millers and manufacturers and distributors of millfeeds to hedge their unprotected position in bran and shorts. The maximum, minimum, and average daily open contracts by contract markets for the year are shown in table 42.

TABLE 42.—*Millfeeds: Maximum, minimum, and average daily open contracts, by contract markets, fiscal year 1939*

Market	Maximum	Minimum	Average
	Tons	*Tons*	*Tons*
Kansas City Board of Trade	20,900	7,275	12,809
St. Louis Merchants' Exchange:			
St. Louis delivery	2,500	800	1,645
Chicago delivery	20,200	8,400	13,702
Total			28,156

Traders in millfeed futures having open commitments in a single future of as much as 1,000 tons are required to report their positions and trades to the Administration. Under this requirement 13 traders reported positions in millfeed futures during the year. Because of the small number of reports made, details of the positions reported are not published in this report.

As shown in table 40, 3.39 percent of the total volume of trading during the life of all futures maturing in the year was settled by delivery.

WOOL TOPS

By amendment approved April 7, 1938, wool tops were added to the commodities covered by the Commodity Exchange Act. Futures trading in wool tops was thus brought under the supervision of the Administration in the same way as other important agricultural commodities.

In 1931 a wool top exchange was organized in New York (officially known as Wool Associates of the New York Cotton Exchange, Inc.). The purposes which were given for the formation of this market were: (1) To furnish a market which would offer hedging facilities to producers, dealers, and processors; (2) to offer a continuous, liquid market whose prices would be published currently; and (3) to enable price opinion to focus in one place, thereby rendering the market more keenly competitive and more responsive to supply and demand factors than it otherwise would be. Wool tops, a standardized semimanufactured product, which is wool that has been scoured and combed, was chosen as the medium for trading, instead of grease wool because of difficulties in grading and the wide variability in the amount of foreign matter in the grease wool.

The steady development of the volume of transactions on that exchange indicated a substantial interest in it. A rapid expansion of the market began during 1937, resulting in a volume of trading during 1938 nearly four times as great as that of any preceding fiscal year. This figure was then increased by 5 percent during 1939. Coincident with this marked increase in the volume of futures transactions, spot and futures prices both declined approximately 40 percent from the relatively high levels reached during the period from December 1936 to April 1937. Wool dealers with large unhedged inventories suffered severe losses during this price decline. The losses of hedged dealers were much smaller proportionately and this was responsible for an increased interest by members of the wool trade in the futures market and its functioning. In some quarters it was felt that the futures market offered a valuable service to the wool trade in providing a mechanism through which inventories could be hedged. Others contended that it was subject to manipulation, and had affected prices in a manner contrary to the public interest. By placing futures transactions under the jurisdiction of the Administration it was the expectation of Congress that any manipulation, fictitious transactions, bucketing, or other undesirable practices would be eliminated.

In accordance with the provisions of the statute as amended, the New York Wool Top Exchange was designated a contract market and was authorized to conduct trading in wool top futures. Rules were issued requiring every futures commission merchant and every floor broker handling or executing orders for others to register with the Administration.

In order to secure data on wool tops similar to that secured on other commodities the Secretary of Agriculture under date of July 27, 1938, issued regulations requiring all clearing members of the exchange to report daily and

requiring every person holding or controlling 125,000 pounds in any one wool top future to report daily his purchases, sales, and other pertinent information. The purpose of these reports is to enable the Administration to know at all times the source, character, and extent of the trading operations of each large trader.

As soon as funds became available on July 1 an investigation of the futures market in wool tops was begun. Its first phase is a detailed study of all futures operations on the New York Wool Top Exchange from September 1936 to June 1938. The investigation will determine what persons have traded in the futures market, the classes of traders who were responsible for the rapid increase in volume of trading and the effects of their trading operations. The study will be based upon the entries of trades in wool top futures on the books of futures commission merchants and on information as to the type of customer secured from commission houses and other sources.

The second phase of the investigation is an attempt to discover the extent to which spot wool houses have made use of the futures market, and in what way such futures operations have affected their methods of doing business. It is expected this report will be completed during the fiscal year 1940.

Meanwhile, the Administration is currently scrutinizing the daily reports received from firms and individuals to detect any evidence of manipulation or other illegal practices. The Administration has also been issuing each day through the New York office statistics on the volume of trading and open contracts by futures so that everyone interested may know the extent of futures operations. It is undoubtedly true that the knowledge of the supervision of these transactions by an agency of the Federal Government acts as a deterrent to persons who otherwise might be inclined to indulge in improper practices. It should also be a measure of reassurance to those persons who might be inclined to suspect improper activities on the exchange.

VOLUME OF TRADING

As shown in table 43, the volume of trading during the year reached a record total of 64,665,000 pounds, an increase of 5 percent over the 1938 total of 61,410,000 pounds. This total was 269 percent greater than the annual average of 17,545,000 pounds for the 7 years 1932–38 since the exchange began operations.

TABLE 43.—*Wool tops: Volume of trading on the New York Wool Top Exchange,*[1] *all futures combined, fiscal years 1932–39*

[In thousands of pounds, i. e., 000 omitted]

Fiscal year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1932	450	340	555	400	390	275	325	530	305	345	260	360	4,535
1933	285	1,060	740	595	285	360	415	585	520	705	1,120	670	7,340
1934	600	415	695	610	580	445	975	1,045	530	935	875	720	8,425
1935	360	960	925	535	1,005	645	770	675	480	875	2,600	1,440	11,270
1936	660	1,125	1,520	1,080	760	1,015	1,300	745	750	885	1,165	1,010	12,015
1937	495	475	1,100	740	1,940	1,400	2,270	1,265	1,715	3,100	1,755	1,565	17,820
1938	1,495	1,330	3,235	4,540	8,765	4,430	4,925	8,435	5,700	4,360	4,970	9,225	61,410
Average	621	815	1,253	1,214	1,961	1,224	1,569	1,897	1,429	1,601	1,821	2,141	17,545
1939	9,030	4,395	5,480	7,285	6,495	4,095	4,465	4,020	4,225	5,380	5,125	4,670	64,665

[1] Official name is Wool Associates of the New York Cotton Exchange, Inc.

While it is impossible to estimate accurately the value of this volume of futures trading in wool tops, it is estimated to be approximately $54,000,000, a 4-percent decline from the estimated value of $56,000,000 for 1938, because of relatively lower prices of wool tops in 1939.

OPEN CONTRACTS

Table 44 reveals the natural tendency for open contracts to advance from a low in the spring to a high in August paralleling the increase in stocks as the spring clip moves to market. The seasonal fluctuation in wool tops is relatively much greater than in wheat, corn, or cotton.

TABLE 44.—*Wool tops: Maximum, minimum, and average open contracts on the New York Wool Top Exchange,[1] fiscal year 1939*

[In thousands of pounds, i. e., 000 omitted]

Year and month	Maximum	Minimum	Average	Year and month	Maximum	Minimum	Average
1938				1939			
July	(2)	(2)	(2)				
August	8,445	8,040	8,253	January	6,300	6,085	6,194
September	8,180	7,160	7,740	February	6,135	5,430	5,645
October	7,430	6,620	6,997	March	5,720	5,460	5,578
November	7,435	7,055	7,244	April	6,025	5,680	5,896
December	7,015	6,380	6,786	May	6,520	5,980	6,288
				June	6,300	6,000	6,202
				Average [3]			6,604

[1] The official name is Wool Associates of the New York Cotton Exchange, Inc.
[2] Open contracts not available.
[3] Average computed from total open contracts for 11 months.

SPECIAL ACCOUNTS

Reporting requirements for holders of large positions in wool top futures went into effect on September 15, 1938. They provided that every individual or firm having a position of as much as 125,000 pounds in any one future on the contract market should make daily reports of his holdings. Up to the end of the fiscal year such reports had been received from 27 large traders in wool tops. In wool tops the positions reported have been a larger proportion of total commitments than in the case of any other commodity. They averaged about 78 percent of all short commitments and approximately 46 percent of long commitments; the major positions reported were hedging (table 45). Short hedges constituted about 4,670,000 pounds, or 74 percent, of all short commitments, and reported long hedges accounted for 1,990,000 pounds, or over 31 percent, of the long commitments in the market. Long speculative activity by the large, reporting traders was considerable, averaging 894,000 pounds, or 14 percent, of all long commitments or about 5 times as much as their short speculative positions of 167,000 pounds.

TABLE 45.—*Wool tops, all futures on New York Wool Top Exchange: Average daily total commitments of reporting traders classified according to purpose and estimated total commitments of traders not subject to reporting requirement, fiscal year 1939*

[In thousands of pounds, i. e., 000 omitted]

Year and month	Total open contracts [1]	Small traders (estimated) [2]		Traders subject to 125,000-pound reporting requirement reported as—						Total	
				Speculative		Hedging		Straddling			
		Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938											
July	(3)										
August	(3)										
September	(3)										
October	6,997	4,988	1,154	695	427	1,207	5,309	107	107	2,009	5,843
November	7,244	4,435	1,492	955	499	1,714	5,113	140	140	2,809	5,752
December	6,786	3,495	1,317	1,045	463	2,217	4,977	29	29	3,291	5,469
1939											
January	6,194	2,997	814	972	144	2,225	5,236			3,197	5,380
February	5,645	2,849	1,063	782		2,011	4,576	3	6	2,796	4,582
March	5,577	2,699	1,612	702		2,152	3,935	24	30	2,878	3,965
April	5,896	2,497	1,159	1,247	3	2,136	4,636	16	98	3,399	4,737
May [4]	6,287	3,157	1,615	991		2,084	4,434	55	238	3,130	4,672
June [4]	6,202	3,257	1,950	699	1	2,144	3,945	102	306	2,945	4,252
Average [5]	6,309	3,372	1,363	894	167	1,990	4,670	53	109	2,937	4,946

[1] See description of method of compiling these figures in the section on "Open contracts."
[2] See footnote, p. 5.
[3] Data not available prior to Oct. 1, 1938.
[4] Preliminary data. [5] Average for 9 months (221 trading days).

TRADING IN FOREIGN MARKETS

Large wool top traders were also distinguished by the size of their positions in foreign markets. Their operations abroad were almost entirely confined to hedging, with a small amount of straddling long in foreign markets and short in New York. This may be seen from the comparison of reported domestic and foreign positions presented in table 46. Short hedges in the European market were very large and in June 1939 averaged more than similar hedges reported in New York. For no other regulated commodity does any type of trading by reporting traders in foreign markets come so close to equaling the corresponding type of trading in domestic markets.

TABLE 46.—*Wool top futures: Average daily total commitments of reporting traders in domestic and foreign markets classified according to purpose, fiscal year 1939*

[In thousands of pounds, i. e., 000 omitted]

Year and month	Total commitments in domestic markets reported as—							
	Speculative		Hedging		Straddling		Total	
	Long	Short	Long	Short	Long	Short	Long	Short
1938								
July	(1)							
August	(1)							
September	(1)							
October	695	427	1,207	5,309	107	107	2,009	5,843
November	955	499	1,714	5,113	140	140	2,809	5,752
December	1,045	463	2,217	4,977	29	29	3,291	5,469
1939								
January	972	144	2,225	5,236			3,197	5,380
February	782		2,011	4,576	3	6	2,796	4,582
March	702		2,152	3,935	24	30	2,878	3,965
April	1,247	3	2,136	4,636	16	98	3,399	4,737
May [2]	991		2,084	4,434	55	238	3,130	4,672
June [2]	699	1	2,145	3,945	102	306	2,946	4,252
Average [3]	894	167	1,990	4,670	53	109	2,937	4,946

Year and month	Total commitments in foreign markets reported as—								Total commitments all markets	
	Speculative		Hedging		Straddling		Total			
	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short
1938										
July										
August										
September										
October			40	2,569			40	2,569	2,049	8,412
November			121	3,027			121	3,027	2,930	8,779
December	27		132	3,625			159	3,625	3,450	9,094
1939										
January	50		422	3,846			472	3,846	3,669	9,226
February	38		691	4,223	3		732	4,223	3,528	8,805
March	13		627	4,184	6		646	4,184	3,524	8,149
April	57		517	4,143	82		656	4,143	4,055	8,880
May [2]	36		412	4,150	183		631	4,150	3,761	8,822
June [2]	25		442	4,715	204		671	4,715	3,617	8,967
Average [3]	27		379	3,840	55		461	3,840	3,398	8,786

[1] Data not available prior to Oct. 1, 1938.
[2] Preliminary data.
[3] Average for 9 months (221 trading days).

DELIVERIES

Slightly more than 2 percent of all wool top futures contracts maturing during the fiscal year was settled by delivery, as shown in table 47. The larger percentages for August and January may be disregarded in view of the small totals involved.

TABLE 47.—*Wool tops: Total futures contracts settled by delivery on the New York Wool Top Exchange,[1] fiscal year 1939*

Futures	Total volume of trading during life of futures maturing in fiscal year [2]	Futures contracts settled by delivery		Futures	Total volume or trading during life of futures maturing in fiscal year [2]	Futures contracts settled by delivery	
1938	*1,000 pounds*	*1,000 pounds*	*Percent*	1939	*1,000 pounds*	*1,000 pounds*	*Percent*
July	11,875	500	4.2	January	35	5	14.3
August	75	25	33.3	February	275	0	0
October	19,730	585	3.0	March	21,142	105	.5
December	19,185	315	1.6	May	8,708	260	3.0
				Total	81,025	1,795	2.2

[1] Official name is Wool Associates of the New York Cotton Exchange, Inc.
[2] These totals not comparable with those of the volume of trading during the fiscal year inasmuch as trading began approximately 12 months before delivery month and consequently covers a period different rom the fiscal year.

GENERAL ACTIVITIES

FUNCTIONS OF THE COMMODITY EXCHANGE ADMINISTRATION

The Administration is charged by law with the enforcement of the Commodity Exchange Act (7 U. S. Code, 1–17a). That act provides for the regulation of futures trading and of the commodity exchanges which conduct trading in 14 of the principal agricultural commodities, viz: Wheat, cotton, corn, oats, rye, barley, flaxseed, grain sorghums, rice, millfeeds, butter, eggs, potatoes, and wool tops.

The general purpose of the law is to insure fair practice and honest dealing on commodity exchanges. Futures commission merchants and floor brokers must register with the Secretary of Agriculture before they may engage in soliciting or executing orders for the purchase or sale of commodities included in the act. Limitations must be placed upon speculative short selling as well as speculative buying when, after notice and hearing, it is found necessary in order to prevent or diminish excessive speculation as a burden on interstate commerce. All futures commission merchants (whether members or nonmembers of a contract market) are required to treat and deal with all margin moneys as belonging to the customer from whom received and shall not commingle such funds with the funds of the commission merchant and may not use them to margin or guarantee the trades of or extend credit to any person other than the one for whom the same are held.

The act provides that certain practices, such as fraud, cheating, and bucketing, and certain types of transactions, such as wash sales, cross trades, etc., are made criminal offenses. The issuance of false or misleading or knowingly inaccurate reports concerning crop or market information or conditions that affect the price of any commodity is made illegal. In addition to these prohibitions, provision is made for the prevention of manipulation and corners.

All contracts of sale for future delivery on or subject to the rules of any board of trade in the United States of any of the supervised commodities must be made by or through a member of a board of trade that has been designated as a contract market. Designation of boards of trade as contract markets can only be made upon a showing that the board of trade has complied with certain prescribed requirements and conditions, the most important of which relate to (1) location and conditions under which cash commodities are sold, (2) the filing of reports showing the details of all cash-grain and grain-futures transac-

tions of its members, (3) the prevention of dissemination of false or misleading crop or market information, (4) the prevention of manipulation of prices or the cornering of any commodity, (5) the admission of financially responsible farmers' cooperative associations, and (6) the making effective of orders denying trading privileges to persons found by the commission created by the act to have violated any of the provisions of the act or the regulations thereunder.

The act also authorizes the investigation of trading practices and conditions and the publication of reports concerning them. There is a close tie-up between the administration of the act and the broader economic studies being pursued by the Bureau of Agricultural Economics. There is also an intimate contact between the Administration and other bureaus of the Department having to do with production and marketing statistics, with the administration of the Federal Warehouse Act, and with grades and standards applying to commodities deliverable on futures contracts.

COOPERATION OF COMMODITY EXCHANGES

The Administration, generally speaking, has had the cooperation of the exchanges in carrying on its activities. At the invitation of each exchange a member of the field staff of the Administration attends all meetings of its business conduct committee. Those committees investigate the dealings, transactions, and financial condition of members whose operations or trading practices are questioned or about which there has been complaint. Through attendance upon those meetings the Administration is in position to keep currently informed of irregularities and take whatever action supplementary to that taken by the exchanges may be required.

Several of the exchanges have also cooperated with the Administration by making available to it copies of quarterly financial statements of their members. This privilege of reviewing quarterly financial statements of member firms is a material aid to the Administration in discovering and acting upon cases of improper segregation of customers' funds.

CONTRACT MARKETS ON JUNE 30, 1939

The following tabulation shows the name of each contract market, as of June 30, 1939, together with the regulated commodities in which trading was conducted during the year.

Market	*Regulated commodity*
Chicago Board of Trade	Wheat, corn, oats, rye, and cotton.
Chicago Mercantile Exchange	Butter, eggs, and potatoes.
Chicago Open Board of Trade	Wheat, corn, oats, and rye.
Duluth Board of Trade	Wheat, rye, and flaxseed.
Kansas City Board of Trade	Wheat, corn, oats, and millfeeds.
Los Angeles Grain Exchange	Barley.
Milwaukee Grain and Stock Exchange	Wheat, corn, oats, and rye.
Minneapolis Chamber of Commerce	Wheat, corn, oats, rye, barley, and flaxseed.
New Orleans Cotton Exchange	Cotton.
New York Cotton Exchange	Cotton.
New York Mercantile Exchange	Eggs.[1]
New York Produce Exchange	([2]).
Portland Grain Exchange	Wheat.
St. Louis Merchants' Exchange	Millfeeds.[3]
San Francisco Grain Exchange	Barley.
Seattle Grain Exchange	Wheat.
Wool Associates of the New York Cotton Exchange	Wool tops.

[1] No trading in butter futures since May 1938.
[2] No trading in wheat futures since April 1932.
[3] No trading in wheat and corn futures since April 1938; no trading in oat futures since August 1937.

REGISTRATION OF COMMISSION MERCHANTS AND FLOOR BROKERS

During the year 795 registration certificates were issued to futures commission merchants, 57 of which were for the period ended December 31, 1938, and 738 for the period ending December 31, 1939. A total of 543 floor broker registra-

tions was issued, 18 of which were for the period ended December 31, 1938, and 525 for the period ending December 31, 1939. In addition to the registrations issued, 1,691 duplicate futures commission merhcant registration certificates were issued, 161 of which were for 1938 and 1,530 for 1939. Fees received for regis rations and duplicate certificates issued during the year amounted to $16,762.

The tabulations in the appendix show the number and location of registered futures commission merchants as of June 30, 1939.

UNLAWFUL TRANSACTIONS AND PRACTICES

One of the important provisions of the act, section 4b, prohibits cheating, defrauding, and deceiving in connection with commodity transactions in interstate commerce as well as in connection with futures transactions. Section 9 makes violation of section 4b a misdemeanor punishable by a fine of not more than $10,000 or imprisonment for not more than 1 year, or both. The Administration has made a vigorous effort to uncover and prosecute every violation of that provision which has occurred. The field accountants of the Administration work under general instructions to be alert at all times to discover violations of this section. Most of the violations are brought to the attention of the Administration by its field accountants.

Outstanding among the cases which were dealt with during the year was the so-called *Gongoll case.* On August 25, 1938, Stanley W. Gongoll, of Minneapolis, and eight affiliated companies, were charged by the Secretary of Agriculture with unlawfully operating as futures commission merchants and with failing properly to account for customers' funds. Those charges precipitated a rapid series of events. Shortly after they were preferred, Gongoll went into voluntary receivership, was then forced into involuntary bankruptcy, and, after investigation by State authorities, was indicted under charges of grand larceny, embezzlement, and swindling. Gongoll signed a stipulation admitting the facts alleged in the complaint of the Secretary, and waived a hearing. An order was issued in November 1938 denying to him and to his affiliated companies trading privileges on all contract markets until further notice. Since Gongoll had burned a large part of the records of his transactions, complete information is not available, but the records which remain indicate that he had more than 3,100 customers and that the loss suffered by his customers will range between one and three million dollars.

Shortly thereafter Gongoll was found guilty by the jury at a trial in the Hennepin County district court (Minnesota) on the first indictment for grand larceny and in December was sentenced to 10 years' imprisonment in the State penitentiary. Counsel noted an appeal to the Minnesota Supreme Court, and in the meantime another indictment for grand larceny was returned by the grand jury. In March 1939 he abandoned his appeal to the State Supreme Court and was committed to the State reformatory at St. Cloud, Minn.

H. W. Armstrong & Co., et al.—Despite the frequent warnings to the public issued by the Administration against speculative schemes under which profits are said to be assured there are a certain number which are developed, fail, and cause resentment and complaints. Such a scheme, known as the Buchhalter plan, was launched during the year by William C. Durant and Joseph Buchhalter, of New York City, trading through the firm of H. W. Armstrong & Co.

The method of trading under the Buchhalter plan was the execution of grain futures orders on the Chicago Board of Trade through power of attorney which put the customer's account in spread positions between futures. If either side of the spread showed a profit of 1 cent the profit was taken, but the position was reestablished so that further profits could be taken if the market continued to move in the same direction. As a result, however, large unrealized losses accumulated on the other side of the spread.

Administration accountants and investigators found that purchase and sales statements were sent by H. W. Armstrong & Co. to customers to show the realized profits on the closed trades and that frequently checks were sent to the customers although the accounts had unrealized losses on the open trades greatly in excess of the unrealized profits. Under this scheme of trading customers were led to believe that they were assured weekly or monthly "incomes," the amount depending entirely upon the amount of the original "investment."

In March 1939 a complaint was issued by the Secretary against William C. Durant, Joseph Buchhalter, H. W. Armstrong & Co., Alexander Eisemann & Co., and certain officers and employees of those two companies, charging that through

the operation of the so-called Buchhalter plan customers had been cheated and defrauded. The hearing on the complaint was completed on May 2. Shortly thereafter counsel for the Government announced that dismissal of the complaint against Alexander Eisemann & Co. would not be opposed inasmuch as it appeared from an examination of the evidence adduced at the hearing that Alexander Eisemann and Alexander Eisemann & Co. acted only as brokers in the transactions, taking no part in the promotional activities of the other respondents.

Action on this case was pending at the close of the year.

D. W. Kohler, Chicago, Ill.—In December 1938 D. W. Kohler, of Chicago, Ill., was charged with having illegally accepted orders and traded in privileges or bids and offers, which transactions are prohibited under the act. His demurrer was overruled, and in May 1939 he pleaded guilty in the United States District Court for the Northern District of Illinois and was fined $25 and court costs. This was the first action to be brought under section 4c (B) of the act and involved the solicitation of orders for privilege transactions to be executed on the Winnipeg Grain Exchange.

Midwest Grains Securities, Billings, Mont.—During a routine audit of the books of Guy D. Marianette, an individual trading as Midwest Grains Securities, Billings, Mont., it was found that he bucketed customers' orders, reported sales to customers at prices different from those at which the trades were actually executed, and failed to keep proper records of commodity futures transactions. Under date of July 15, 1939, a complaint was issued by the Secretary of Agriculture charging the respondent with violating the act. In view of these apparent violations of the act it was recommended that this individual be ordered to show cause why he should not be denied trading privileges on all contract markets and have his registration as futures commission merchant revoked.

TRADING FOR OTHERS IN COMMODITY FUTURES

On August 30, 1937, the Administration called upon every registered futures commission merchant to report concerning every commodity account controlled through power of attorney or otherwise by any person other than the owner. It was found that 4,488 accounts were controlled by 3,257 individuals other than the owners. Of these trading accounts, approximately 600 were managed by so-called professional commodity counselors.

The reports received in response to that call disclosed a thoroughly unhealthy situation insofar as the activities of the so-called commodity counselors were concerned. Many counselors engaged in unethical and socially undesirable practices, such as allocating orders among customers hours or even days after the trades had been executed, closing out profitable trades and dividing the profit while unprofitable trades were held open without the knowledge of the owners, and not notifying customers of unrealized losses in accounts.

In response to an invitation from the Secretary of Agriculture, officials of the leading commodity exchanges met in Washington on August 1, 1938, to consider methods of preventing commodity counselors from defrauding the public through promises of extraordinary profits from dealings on the commodity exchanges. As a result of the disclosures made at this conference every contract market represented adopted amendments to its rules to prevent such practices. If these regulations are effectively enforced they should preclude the major malpractices by which commodity counselors have misled or deceived their customers. A comprehensive report of this investigation is now in the hands of the printer and should be available to the public shortly.

PROTECTION OF CUSTOMERS' MARGIN MONEYS

The value and practicality of section 4d (2) of the act which provides for the segregation and proper handling of customers' funds has been amply demonstrated during the year. That section provides that futures commission merchants shall treat and deal with all margin moneys, including securities and property, as belonging to the customer from whom received. All such money, securities, and property must be separately accounted for and may not be commingled with the funds of the commission merchant, nor may they be used to margin or guarantee the trades or contracts of or to extend credit to any person other than the one for whom the same are held.

The existence of this provision of law has had a salutary effect on the conduct of futures trading. But it has been necessary to examine the books and records

of futures commission merchants to assure compliance with it. Audits were made of the books and records of nearly 800 firms which had registered with the Administration. The purpose of these audits is to ascertain whether the commission merchant is complying with the law and if not to take remedial action.

The Administration has, generally speaking, received the hearty cooperation of the trade in the conduct of these audits and in revising procedures and correcting errors which were found to exist. A marked improvement in record keeping and in technical compliance with the law and regulations has been noticeable.

A large percentage of the cases which required formal action were the result of the supervisory work of the field accountants of the Administration. A brief summary of some of the more important cases follows:

BURKE & CO., SIOUX FALLS, S. DAK.

In August 1938 a complaint was issued under section 6 (b) charging Stephen A. Burke, president, and Hugh S. Gamble, vice president, of Burke & Co., a futures commission firm, with failure properly to segregate customers' funds and operating as futures commission merchant without registration. Their failure to segregate customers' funds from their own and the use of their customers' funds for personal speculation had resulted in a shortage to their customers of approximately $60,000. When the respondents failed to appear either personally or by attorney at the public hearing which was held on August 17 an order was issued denying those respondents trading privileges on all contract markets until further notice.

Final liquidation of this bankrupt firm was completed in February. Commodity customers' claims were given preference in the distribution of the funds segregated for their benefit as provided in the act, and such customers participated also as common creditors for the balance of their claims. As a result the commodity customers received about 46 percent of their claims, while the common creditors received only 28½ percent. This is the first case in which the segregation requirements of the act have been a factor in a bankruptcy proceeding, and the action of the referee in bankruptcy in recognizing the preferred status of commodity customers with respect to segregated funds establishes a precedent important in the application of this section of the act in the future.

H. O. BEDFORD & CO., EL PASO, TEX.

The operation of a bucket shop and misappropriation of commodity customers' funds by H. O. Bedford, a futures commission merchant operating as H. O. Bedford & Co., of El Paso, Tex., was disclosed by an audit of his books and records which was made in April 1938. Bedford was sentenced in State court to 3 years in the penitentiary on these charges. Criminal prosecution for violation of the act is under consideration at the present time.

N. J. LARIMER & CO., WENATCHEE, WASH.

In January 1939 the futures commission merchant firm of N. J. Larimer & Co., of Wenatchee, Wash., was found to have failed properly to segregate customers' funds, having bucketed customers' orders and having failed to keep proper records of commodity futures transactions. Larimer confessed to an accountant of the Administration that he had been operating a bucket shop and the following day pled guilty in the State court and was given an indeterminate sentence with a maximum penalty of 15 years.

N. L. ROGERS & CO., PEORIA, ILL.

In April 1938 N. L. Rogers & Co. was found to have been operating as futures commission merchant without having been registered as required by law and to have failed to account properly for customers' funds. Criminal prosecution was recommended to the Department of Justice, but as the defendants were under indictment under other Federal statutes providing more severe penalties, the Commodity Exchange Act was not invoked. In March 1939 defendants William W. Rogers, Ralph A. Buchele, and Landry P. Locke were brought to trial on charges of using the mails to defraud, fraudulent interstate transactions, and conspiracy. They pleaded guilty and were placed on probation for 3 years, Rogers and Buchele being required to pay court costs.

YOUNG & ALCUS, BRECKENRIDGE, TEX.

As a result of a routine audit of the books and records of the firm of Young & Alcus, Breckenridge, Tex., made in September 1938, it was disclosed that the firm had failed properly to segregate customers' funds, was bucketing orders, was keeping false records, and had made false statements regarding its financial condition. A recommendation for criminal action was made to the Department of Justice. Meanwhile, Young was sentenced to 6 years and Alcus to 10 years in the penitentiary by the Texas State court on charges of grand larceny and embezzlement. Further action under the Commodity Exchange Act was not considered advisable.

H. H. HEARD, FLORENCE, S. C.

In August 1938 H. H. Heard, a futures commission merchant, of Florence, S. C., was found to have failed properly to segregate customers' funds. Heard's registation as futures commission merchant was revoked on October 10, but further action was not considered necessary inasmuch as he made complete restitution of misappropriated funds.

CLYDE VEDDER & CO., HOLLYWOOD, CALIF.

An audit of the records of the brokerage house of Clyde Vedder & Co., of Hollywood, Calif., which was made by the accountants of the Administration, disclosed failure to segregate, which resulted in shortages in customers' funds of $18,800.79 on June 30, 1937, of $4,670.78 on November 30, 1937, and of various other amounts on other dates. After a hearing of the charges an order was issue denying Vedder trading privileges on all contract markets. Vedder was also tried in California superior court in Los Angeles on charges of grand theft and on March 15, 1939, was given a sentence of 1 to 10 years in San Quentin Prison.

STERLING & BAKER, HOUSTON, TEX.

Sterling & Baker, a brokerage house of Houston, Tex., was found in November 1937 to have misappropriated commodity customers' funds. Criminal action under the act was recommended to the Department of Justice, but in view of previous successful prosecution under the Securities Exchange Act the United States attorney of the southern district of Texas recommended that the charges not be pressed. Action before the Secretary under section 6 (b) of the act to deny the partners of this firm trading privileges on all contract markets is pending.

ANALYSIS OF FINANCIAL STATEMENTS

Every person or firm applying for registration as a futures commission merchant is required to furnish a current financial statement. Inasmuch as futures commission merchants must register once a year the Administration has at all times reasonably up-to-date knowledge of the financial condition of all commission merchants. Such information aids in the administration of the segregation provision of the act.

ESTABLISHMENT OF LIMITS UPON SPECULATIVE TRADING

Section 4a (1) of the act authorizes the Commodity Exchange Commission to fix limitations both upon the amount of speculative trading that may be done by any person during any one business day and upon the amount of the speculative net position, long or short, that may be held by any person at any time. The limitations are applicable only to speculative trading and speculative positions; the law specifically exempts hedging transactions and the Commission may exempt spreads and straddles.

The purpose of such limitations is not to destroy speculation. The Administration has repeatedly stated that a reasonable amount of speculation is required to give a liquid character to the futures markets and to furnish a readily available means whereby merchants and processors may hedge their risks. The purpose of such limitations is to prevent excessive speculation.

LIMITS FIXED ON SPECULATIVE TRADING IN GRAIN

On December 22, 1938, after public hearings had been held in Chicago, the Commission established limits on speculative trading in grain futures which became effective on and after December 31, 1938. The order covered wheat, corn, oats, barley, rye, and flaxseed on all contract markets.

The limit on the net long or short position which any person may hold was set at 2,000,000 bushels in any one future or in all futures combined of any one grain on any one contract market. On spreads between markets a position of 3,000,000 bushels in all futures combined was allowed, subject to a limit of 2,000,000 bushels in any one future The same limits were fixed governing the amount of purchases or sales that may be made during one business day. The establishment of these limits gives assurance that in the future unreasonably large speculative lines will not exist.

LIMITS ON SPECULATIVE TRADING IN COTTON PLANNED

The Administration has been making surveys preliminary to holding public hearings on desirable limits on speculative trading in cotton futures. It is contemplated that the limit on speculative transactions in cotton will be a certain percentage of the total open contracts of each future. Such a limit would have the advantage of maintaining some definite relation to the volume of trading. At times such as the present when open contracts are comparatively small the limit would be low, whereas if they increase the limit would automatically increase. It is not contemplated that the limit will be so low as to interfere in the least with any legitimate trading; it will only prohibit excessive speculation which is demoralizing to the whole market.

SPECIAL INVESTIGATIONS

CARGILL, INC. V. CHICAGO BOARD OF TRADE

Mention was made in the last annual report of this Administration of the controversy between Cargill, Inc., one of the largest cash-grain houses in the United States, and the Chicago Board of Trade which had developed primarily over the 1937 September corn future. When congestion developed in that future the Chicago Board of Trade called upon the Cargill Grain Co., a subsidiary of Cargill, Inc., to liquidate a part of its long position in September corn. At one time the Cargill Grain Co. held 80 percent of the total long open contracts. Upon its failure to comply, the Chicago Board of Trade expelled the Cargill Grain Co. from membership representation. Shortly thereafter Cargill, Inc., filed a complaint with the Commodity Exchange Commission charging the Chicago Board of Trade with having violated the Commodity Exchange Act in 1936 and again in 1937.

Exhaustive hearings of the complaint have been held during the year before a referee appointed by the Commission. At the close of the year, the referee had under advisement a motion made by counsel for the Chicago Board of Trade to dismiss the complaint made by Cargill, Inc.

While the hearing of this controversy was being conducted, an investigation was being made by the Administration of the activities of Cargill, Inc., and the Cargill Grain Co. of Illinois, to determine whether those corporations had been guilty of manipulating the price of September 1937 corn by means of the operation of a corner and at the same time depressing the price of the December 1937 corn future through speculative short sales.

CARGILL, INC., MINNEAPOLIS, MINN., CHARGED WITH MANIPULATION

In December 1938 the Secretary of Agriculture brought charges against Cargill, Inc., and a subsidiary of Cargill, Inc., together with certain officers of both companies. In the Secretary's complaint it was alleged that the Cargill interests engaged in manipulative short selling of the 1937 December corn future on the Chicago Board of Trade to the extent of about 10,000,000 bushels, at the same time operating a corner in the 1937 September corn future. The complaint charged that these manipulations had the effect of creating an artificially high price during September, when producers had practically no grain to market, and that the reaction to the manipulation resulted in an abnormally low price

immediately after the expiration of the corner, when the new crop was moving to the market. The complaint also alleged that the Cargill interests engaged in wash sales on the Minneapolis Chamber of Commerce in March 1938 for the purpose of creating a false impression of market activity and stimulating public participation in the Minneapolis market.

Hearing on this complaint was originally set for January 10, but was continued because of the fact that the case of Cargill against the Chicago Board of Trade was at that time being heard before a referee representing the Commodity Exchange Commission. As the hearing in the latter case came to a temporary close on June 5, the Secretary issued an order appointing a referee and setting the hearing for July 31 at Washington, D. C.

COTTON

At three different times during the year—in December, March, and June—congestion in the cotton market developed to the point where serious price disturbances threatened. By congestion is meant a condition where one or a few traders control such a large percentage of the open contracts that prices may be unduly influenced by the operations of those traders or where, toward the end of the life of a future, delay of liquidation by longs may cause the maturing future to advance in relation to more distant months and relative to prices of the cash commodity.

DECEMBER CALL

As December 1, the first delivery day for the December future, neared, the premiums for the December future over the more distant months increased steadily. The open interest was being liquidated so slowly that it became evident congestion was likely. About that time approximately 64 percent of the open interest in the December future was owned by small traders. In an endeavor to secure complete information upon the ownership of open contracts, a call was issued by the Administration on December 2 for the name, address, and classification (that is, whether speculator, hedger, straddler, or commission house) of all owners of the December future. Replies to the call indicated that 122 traders held long positions against 98 on the short side. In general the traders of all the different categories were drawn from many different States and foreign countries.

It was significant that a relatively large number of speculators were on the long side, particularly when it is realized that by December 2 the December future was subject to current liquidation by delivery. It is generally presumed that speculators do not want actual cotton. Nevertheless, a large number of speculators had remained in the December future after it was possible for them to receive cotton.

It was apparent that many of the speculators, representing a large number of small accounts, distributed over the United States and foreign countries, hoped to gain from an advance in the price of the December future by offset trade rather than by receipt of actual cotton. On the other hand hedgers owned a considerable part of the long interest and were thus in a position to take delivery of cotton on the futures contract.

There was no evidence of collusion among members of the New York Cotton Exchange. It appears, however, that the Government loan program has had a tendency to maintain the price of spot cotton and near futures, while the more distant futures have tended to sell at an unusual discount and the holders of long positions therefore hoped to benefit from an increase in the December premium. When those longs liquidated, their hasty and urgent selling depressed the market.

MARCH CALL

Following a decline of 57 points in the March cotton future, which occurred on March 17, the day on which trading in that future ceased, the Administration called upon all clearing members of the New York Cotton Exchange to report all trades which had been made on that day. Clearing members were also instructed to have all of their nonclearing commission-house customers report the same information. This call was issued because the regular special reports (those

from persons holding 5,000 bales or more) did not explain the severe decline which had taken place.

The information secured revealed that the break was caused by a rather small number of longs who had overstayed the market, apparently in the belief that the shorts would endeavor to cover. Instead a short having an interest of 3,000 bales did not cover, but waited until after the market closed to issue his notices. Consequently, when in the last few minutes of trading the longs endeavored to liquidate, they found buyers were lacking, and the price dropped abruptly. Other months did not react to the decline in March. There were no notices circulated during the last 3 minutes when the break occurred. Of the 32 notices issued on March 17, 2 were stopped before the price break, and the remaining 30 were issued after trading had ceased. The New York Cotton Exchange was made to realize the disturbing effect of such a violent price movement arising out of a technical difficulty in market operation and has been watchful to prevent a recurrence.

JULY CALL

Despite the concern which the Administration had registered over the abnormal situations in the December and March futures and the corrective steps which had been taken, another disturbing situation developed in the July 1939 future. At one time during June the July future was quoted at 91 points over October. The spread between the July and October futures continued excessively large, about 60 to 70 points.

Normally open contracts reach a maximum several months before the month in which the future expires and gradually diminishes, reaching zero on the last trading day. When open contracts have failed to decline substantially by the time the final month arrives price disturbance is probable. When open contracts in the July future aggregated 185,000 bales at the close of the market on June 23, the total was entirely too large to be disregarded in view of the unusually small (deliverable and total) supply of cotton in commercial channels and particularly the small stocks in position for delivery. On June 24, therefore, the Administration issued a call for the name, address, and classification of the holders of all open accounts in the July future on the New York and New Orleans cotton exchanges as of the close of trading on June 26 and 27.

CHANGES IN THE COTTON FUTURES CONTRACT

During the year the desirability of amending the futures contracts of the cotton exchanges has been evident, and the trade has discussed many proposals. It has been argued that some of the provisions of the existing contract permitted arbitrary and extraneous influences to disturb the natural relationship between spot and futures prices. Some wished to widen the contract by increasing the number of staples that could be delivered at full commercial premiums. Others favored narrowing the contract by making it conform more closely to specific qualities. If the contract becomes too narrow the likelihood of manipulation increases; if it were widened it would be less attractive to those interested in specific qualities of cotton.

The Administration has been working in close cooperation with representatives of the trade, the exchanges, and the Agricultural Marketing Service in an endeavor to work out changes in the contract which would fill the needs of the entire cotton industry. As a partial solution of this problem the New York Cotton Exchange adopted several amendments to the contract which became effective August 15. They may be summarized as follows:

(1) The base contract shall be fifteen-sixteenths inch instead of seven-eighths inch.

(*a*) Staples of thirty-one thirty-seconds inch and 1 inch shall be tenderable at 75 percent of the commercial premium over fifteen-sixteenths inch.

(*b*) Staples of twenty-nine thirty-seconds inch and seven-eighths inch shall be tenderable at full commercial difference under fifteen-sixteenths inch.

(2) The following grades may be tendered on futures contracts:

(*a*) White cotton—Good Middling, Strict Good Middling, Middling, Strict Low Middling, and Low Middling.

(*b*) Spotted cotton—Good middling, Strict Middling, and Middling Spotted, except that Middling Spotted shall be tenderable only when and if the Agricultural Marketing Service establishes a satisfactory type for Middling Spotted.

NOTE.—Provided that cotton reduced in grade for preparation, or in staple for character, or reduced in value for any other reason, shall not be tenderable.

(3) That nonrain grown cotton shall be tenderable only in grades of Middling and above, and in staples of $1\frac{1}{32}$ inches or longer.

(4) That standard-density and high-density compressed cotton shall be received on contract on the same basis.

(5) That certified cotton remaining in store be penalized 15 cents per bale per month beginning with the eleventh month.

(6) That the receiver of a transferable notice be given 1 hour instead of 20 minutes as at present in which to pass the notice or accept tender.

The New Orleans Cotton Exchange also adopted a new contract which may be summarized as follows:

(1) The base shall be fifteen-sixteenths inch instead of seven-eighths inch.

(*a*) Staples of thirty-one thirty-seconds inch and 1 inch shall be tenderable at full commercial premiums.

(*b*) Staples of twenty-nine thirty-seconds inch and seven-eighths inch shall be deliverable at full commercial discounts.

(2) Nonrain grown cotton shall be tenderable only in grades of Middling and above, and in staples of 1 one thirty-second inch or longer.

The New York and New Orleans contracts are similar in respect to grades deliverable. The New Orleans contract provides for deliveries to be compressed to high density and delivered to shipside free of all charges to the receiver.

It is believed that these changes in the New York and New Orleans contracts will result in better trading conditions and will be of material benefit to producers, shippers, and spinners.

DELIVERY PRACTICES

One of the most vital parts of the futures trading system is the arrangement for adequate deliverable supplies upon futures contracts. Through the right to deliver the actual commodity cash and futures prices are linked together. Although neither hedgers nor speculators ordinarily desire nor expect to take or make delivery, it is of the utmost importance that the machinery for making delivery should be available. Any interruption of or interference with the delivery system may disturb the entire price mechanism of the exchange. For this reason the act confers broad powers to deal with the problems of the delivery system. Numerous problems relating to the delivery system were investigated during the year, and in some cases definite action was taken.

GRAIN

Survey of grain-futures-exchange margin requirements during cessation-of-trading period.—A survey of the practices followed by the several contract markets conducting trading in grain futures with respect to margin requirements during the 7-day cessation-of-trading period which became effective under the order of the Secretary of Agriculture promulgated February 17, 1938, has been made. None of the grain-futures exchanges had modified its rules with respect to clearing-house margin requirements after the cessation of trading in the current future during the delivery month. The survey disclosed that on most of the exchanges the present rules provide sufficient authority for the calling of additional margins during such a period should market-price changes indicate the need thereof. On some exchanges, however, there appears doubt as to the authority conferred by the present rules with respect to the calling of additional margins in the event that open contracts are margined to the settlement price on the last day of trading. Particularly is this true with respect to the Minneapolis Chamber of Commerce. When this situation was called to the attention of the officials of the clearing association of that exchange they expressed their willingness to eliminate any doubt as to the authority to call additional margins during such period. Action upon that point is expected to be taken in the near future by that association.

COTTON

Survey of licensed warehouses and inspection system of the cotton exchanges.—A survey of all warehouses licensed by the New York and New Orleans cotton exchanges and the Chicago Board of Trade in Houston, Galveston, New Orleans, and Mobile, as well as a study of the inspection system employed by the exchanges, was completed.

About 90 percent of all deliveries of cotton in settlement of futures contracts are made at these four delivery points. The survey gives definite information on warehouse practices relative to certificated cotton, the concentration of control of licensed warehouses by cotton merchants, storage and handling charges, etc. In regard to inspection of cotton, practices vary between delivery points relative to weighing, sampling, and supervision.

It is expected that definite recommendations will be made to the exchanges on uniformity in practices between delivery points and the use of independent weighers and samplers under the direct supervision of Government and exchange officials.

Reduction in number of qualities of cotton deliverable under futures contract proposed.—Under the provisions of the futures contracts of all of the cotton exchanges, 60 qualities (grades and staples) may be delivered in settlement of 1 futures contract of 100 bales. This provision of the contract has been severely criticized by some groups in the trade. They maintain that this right to deliver 60 qualities, while not likely to be utilized, does favor the seller and has a detrimental influence upon the futures contract.

In an endeavor to aid in the settlement of this controversy, the Administration has compiled data pertaining to the grades and staples tendered in settlement of each futures contract on the New York Cotton Exchange. Table 48 shows that the number of qualities appearing upon notices issued during the fiscal year averaged 5.8 on 2,041 notices. Sixty percent of all notices issued contained 5 qualities or fewer. The largest number of qualities appearing on any notice was 21. These figures indicate that in actual trade practice the number of qualities upon 1 notice averaged considerably below the maximum of 60. Nevertheless, the possibility of a large number of qualities being delivered was a constant threat to buyers.

TABLE 48.—*Cotton: Number of qualities*[1] *appearing on notices issued in settlement of futures contracts on New York Cotton Exchange, fiscal year 1939*

Qualities (number)	Notices in—						Total	
	July 1938	October 1938	December 1938	January 1939	March 1939	May 1939		
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Percent*
1	28	34	2	23	12	4	103	5.0
2	14	26		13	17	4	74	3.6
3	154	63	20	13	24	5	279	13.7
4	357	44	43	16	28	16	504	24.7
5	161	38	9	12	36	11	267	13.1
6	67	20	10	8	20	12	137	6.7
7	25	34	3	9	15	11	97	4.8
8	13	25	3	6	15	46	108	5.3
9	10	32	2	14	22	44	124	6.1
10	3	99	1	9	13	16	141	6.9
11	5	54		10	13	7	89	4.4
12	4	15	2	6	7	2	36	1.8
13	3	9		5	9	1	27	1.3
14	1	11		2	12	3	29	1.4
15	2			1	7		10	.5
16	1				5		6	.3
17			1		2		3	.2
18					2		2	(2)
19					1		1	(2)
20					2	1	3	.2
21					1		1	(2)
Total	848	504	96	147	263	183	2,041	100.0
Average number on 1 notice	4.4	7.0	4.7	5.9	7.3	7.6	5.8	

[1] A quality is a combination of grade and staple.
[2] Less than 0.1 percent.

In June, after consultation with officials of the Bureau of Agricultural Economics, the Administration proposed to the New York Cotton Exchange the adoption of an express limitation of 5 qualities tenderable under a single contract. It was the belief of the Administration that limiting the number of qualities tenderable to 5 would be a most effective answer to the criticism that the buyer may be compelled to accept delivery of 60 different qualities and at the same time would bring the terms of the contract into conformity with what has been found to be the actual trade practice in nearly two-thirds of all deliveries. This recommendation was under consideration by the New York Cotton Exchange at the end of the year.

BUTTER

Establishment of official standards for creamery butter.—Official standards for quality of creamery butter were promulgated by the Secretary of Agriculture November 3, 1938, effective April 1, 1939. Under the provisions of section 5a (6) of the act, the use of such grades incident to deliveries under futures contracts is mandatory. The official standards promulgated by the Secretary of Agriculture were adopted by the Chicago Mercantile Exchange to be effective with respect to all futures contracts maturing on and after April 1, 1939.

DESIRABLE AMENDMENTS TO THE ACT

During the 3 years which have elapsed since the Commodity Exchange Act in substantially its present form was enacted, many circumstances and problems have arisen in connection with its enforcement which have revealed the need for further amendments. Some of these are of a rather minor character, but some of them are important and urgent.

A minor amendment, but one which should be made immediately, is one which would permit the Administration to compel the attendance and testimony under oath of witnesses and the production of documents in an investigation. The Administration now has this power in connection with formal proceedings which first necessitate the filing of a formal complaint. In connection with general investigations it would be a decided advantage and would facilitate the enforcement of the act if witnesses could be examined under oath in private hearings and their statements made a matter of record.

The penal section of the act should also be amended to provide a possible 5 years' imprisonment instead of the 1-year provision now carried. Also, for certain violations the act should make imprisonment mandatory. On several occasions during the past year instances of gross misappropriation of customers' funds and other malpractices have been discovered. Several of these cases warranted much more severe penalties than the law now provides.

There are also a number of minor defects in the act which should be corrected when an opportunity is offered. Section 4b makes unlawful certain acts of "any member of a contract market" or of "any correspondent, agent, or employee of any member." The language should be broadened to include futures commission merchants who may not be members of any contract market.

INCLUSION OF OTHER AGRICULTURAL COMMODITIES UNDER THE ACT

At the present time there are 14 agricultural commodities under the supervision of the Administration: Wheat, cotton, rice, corn, oats, rye, barley, flaxseed, grain sorghums, millfeeds, butter, eggs, potatoes, and wool tops. Wool tops were added by the act approved April 7, 1938 (52 Stat. 205). There are, however, 15 additional agricultural commodities traded in for future delivery in the United States which do not come within the purview of this Administration. They are: Cheese, cocoa, coffee, cottonseed meal, cottonseed oil, frozen eggs, hides, lard, molasses, peanuts, pepper, provisions (ribs and bellies), soybeans, sugar, and tallow.

Two bills were introduced in the Congress during the year which provided for the inclusion of additional commodities under the act. S. 2377, introduced by Senator Lodge, of Massachusetts, provided for the inclusion of hides, while

H. R. 4088, introduced by Mr. Pace, of Georgia, provided for the inclusion of fats and oils, cottonseed, cottonseed meal, and peanuts. Both bills were approved by the Department and their enactment recommended. H. R. 4088 was passed by the House of Representatives in the closing days of the last session of Congress, but was not voted upon in the Senate. Both bills are now pending before the Senate Committee on Agriculture and Forestry.

While detailed information as to the practices and the character of futures trading in the uncontrolled commodities is not available, it is safe to assume, on the basis of complaints received from time to time, that the same need exists for Federal supervision of futures trading in all unregulated agricultural products as in the 14 commodities now covered by the act. Manipulation, fictitious transactions, and excessive speculation are relatively just as harmful in one group of commodities as in the other.

OBJECTIVES OF THE ADMINISTRATION

Up to this point this report has described the activities and accomplishments of the Administration. It may unintentionally have given the impression that the entire field of futures trading is being satisfactorily covered and that the Administration is satisfied with the progress which is being made. Such is not the case. There are many important activities which should be under way, and there is an even larger field which is being neglected through force of necessity. Brief mention may be made of some of the neglected fields of activity.

Section 4a (1) of the act states that "Excessive speculation in any commodity under contracts of sale of such commodity for future delivery made on or subject to the rules of contract markets causing sudden or unreasonable fluctuations or unwarranted changes in the price of such commodity, is an undue and unnecessary burden on interstate commerce in such commodity. For the purpose of diminishing, eliminating, or preventing such burden, the commission shall, from time to time, after due notice and opportunity for hearing, by order, proclaim and fix such limits * * *." Although the act requires that limitations be established and enforced on speculative transactions in all commodities, it has only been possible up to the present time to establish limitations on speculative grain-futures transactions.

Work has been begun on cotton, but no action whatever has been possible in connection with any of the other five commodities. At the present time the restricted volume of trading in most of these commodities minimizes the likelihood of difficulties over excessive speculative transactions, but such a time is a particularly opportune one for the establishment of such limitations.

The Commodity Exchange Administration and its predecessor, the Grain Futures Administration, have centered attention almost entirely upon the futures markets to the neglect of the trade in the actual physical commodities. Yet several phases of the cash-grain and spot-cotton trades deserve examination. Numerous practices in use in the merchandising of spot cotton are also of major importance to the futures trading system and should be investigated as soon as opportunity offers. Basic information should also be compiled concerning the relationship between cash and futures transactions and such data analyzed and published.

Of a considerably broader character is the whole question of the economic utility of the futures trading system. Despite the fact that trading in commodity futures has been a recognized marketing practice for nearly a hundred years, during which time it has developed into a trade having an average annual value of more than $23,000,000,000, there has been no comprehensive study made of its value in the social structure. Such a fundamental study would not only prove interesting and illuminating but might reveal important facts not now known or appreciated.

APPENDIX

TABLE 49.—*Geographical location of offices of registered futures commission merchants, as of June 30, 1939*

State, city, or country	Principal offices	Branch offices	Total
	Number	*Number*	*Number*
Alabama	4	16	20
Arizona		3	3
Arkansas	2	6	8
California	18	53	71
Colorado	3	7	10
Connecticut	1	19	20
Delaware	2	4	6
District of Columbia	2	8	10
Florida	2	15	17
Georgia	7	20	27
Idaho	1	3	4
Illinois (excluding Chicago)	10	66	76
Chicago	146	35	181
Indiana	4	19	23
Iowa	3	36	39
Kansas	2	40	42
Kentucky	3	6	9
Louisiana	23	15	38
Maine		3	3
Maryland	7	9	16
Massachusetts	14	45	59
Michigan	2	31	33
Minnesota	65	48	113
Mississippi	5	8	13
Missouri	69	35	104
Montana	4	2	6
Nebraska	10	28	38
Nevada	1		1
New Hampshire		3	3
New Jersey	1	35	36
New Mexico		1	1
New York (excluding New York City)	7	76	83
New York City	197	136	333
North Carolina		22	22
North Dakota	1	7	8
Ohio	12	45	57
Oklahoma	4	14	18
Oregon	3	6	9
Pennsylvania	13	85	98
Rhode Island	1	9	10
South Carolina	3	12	15
South Dakota	3	6	9
Tennessee	7	15	22
Texas	14	42	56
Utah	2	1	3
Vermont		2	2
Virginia	1	17	18
Washington	6	16	22
West Virginia		6	6
Wisconsin	7	19	26
Wyoming	1		1
Total	693	1,155	1,848
Hawaii		1	1
Total, United States	693	1,156	1,849
Foreign:			
Argentina		1	1
Brazil			
Canada		19	19
China			
Cuba		1	1
Egypt			
England		24	24
France		6	6
Germany		1	1
India			
Japan		1	1
Monaco		1	1
Netherlands		11	11
Sweden		1	1
Switzerland		1	1
Total		67	67
Grand total	693	1,223	1,916

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REPORT OF THE CHIEF OF THE BUREAU OF DAIRY INDUSTRY, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF DAIRY INDUSTRY,
Washington, D. C., September 1, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith a report of the work of the Bureau of Dairy Industry for the fiscal year ended June 30, 1939.

Sincerely yours,

O. E. REED, *Chief.*

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INTRODUCTION

The Bureau conducted its research and extension activities along the same general lines as in previous years. The principal objectives of the program are to (1) bring about greater economy in milk production, (2) raise the quality of the general supply of dairy products, and (3) create more profitable ways to utilize dairy byproducts.

In the last few years, two trends have become apparent in dairy farming, both of which have long been advocated by the Bureau as essential for greater economy in milk production. One is the increasing use of home-grown feeds, especially roughage crops. The other is the wider use of production records as a guide to breeding.

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Although many farmers still fail to recognize the importance of keeping records of production and following such fundamental practices as culling, feeding, and breeding, for greater efficiency in milk production, there are encouraging signs that some progress is being made in developing better herds through the use of records as a breeding guide. Particularly encouraging is the widespread interest in the proved-sire system of breeding, which the Bureau's breeding investigations indicate to be the surest and quickest way to build up the producing inheritance in the average herd. More and more dairymen are joining herd-improvement associations and are cooperating in the Nation-wide sire-proving program.

The soil conservation program has increased the supplies of roughage on many dairy farms and brought about changes in farming and feeding practices that promise advantages not only in saving the soil but in reducing the cost of milk production. With a good quality of roughage the dairy farmer is able to dispense with much of the grain he was forced to feed in the past, and thus he can lower his unit cost of production. The dairymen's big problem, however, is not only to grow more roughage but to harvest and cure it so that it will be of the best quality for milk production. Recent research information has been particularly effective in showing how to make these crops into silage.

Progress in the research work in the Bureau's various laboratories and at its field experiment stations is summarized in the following pages.

DIVISION OF DAIRY HERD-IMPROVEMENT INVESTIGATIONS

J. F. KENDRICK, *in charge*

STATUS OF ASSOCIATION WORK

Dairy herd-improvement association work in the United States is at an all-time peak. More associations were operating January 1, 1939, and more cows were being tested for milk and butterfat production than ever before. Association work is now being conducted in every State, and in Hawaii and Puerto Rico.

The 1,228 associations in operation January 1, 1939, were testing 25,949 herds consisting of 625,284 cows. During 1938 the number of associations increased 122, or 11 percent, and the number of cows on test 66,291, or 11.9 percent. There was also a net gain of 2,248 association members.

In 1938 the association cows produced 7,832 pounds of milk and 317 pounds of butterfat per cow on an average, whereas, according to estimates made by the Bureau of Agricultural Economics, all cows milked in the United States averaged only 4,359 pounds of milk and 170 pounds of butterfat per cow.

The association cows that produced at the same average rate as all cows in the United States consumed approximately $53 worth of feed per cow and returned $38 above feed cost, whereas the average for all association cows was $71 worth of feed and a return of $98 above feed cost. In other words, the cows that averaged 4,359 pounds of milk consumed $1.22 worth of feed for every hundred pounds of milk they produced, while cows that averaged 7,832 pounds consumed only 91 cents worth of feed for every hundred pounds of milk they produced.

As the influence of association work spreads, more and more herds will have a higher average production per cow and consequently a lower feed cost per hundred pounds of milk. This greater economy in milk production will result in greater net returns for many more dairymen.

CULLING ASSOCIATION HERDS

The average association member could profitably cull at least 20 percent of the cows from his herd because of low production. This was indicated by a study of the individual-cow records of 202 herds selected at random, each consisting of 20 cows, all of which were on test for 12 months. Since the cost of feed usually represents approximately half the total cost of producing milk, a cow should return more than $2 for each dollar's worth of feed to be profitable. On an average, 4 cows in each herd, or 20 percent, failed to produce sufficient milk and butterfat to return $2 for each dollar's worth of feed they consumed.

Association members recognize the need for constant culling, but the average member is not culling his herd as closely as he should. This is indicated by the results of a study showing why association cows were culled last year. This study, which involved association herds consisting of 114,135 cows in 18 States, revealed that only 8.5 percent of the cows were culled because of low production, whereas at least 20 percent should have been culled.

PROVED-SIRE WORK

Proved-sire records for 1,418 sires used in association herds were tabulated during the year. Copies of each proved-sire record were sent to the State extension dairyman in the State where the sire was proved, for transmittal to the owner of the sire, the local association tester, the local county agent, and the State college. Each proved-sire record included in addition to the dam-and-daughter production records, the identification numbers of all recorded sons of the sire. Most State extension dairymen maintain and distribute an up-to-date list of all proved sires and sons of proved sires that are available for purchase in their respective States. By disseminating and utilizing the information included in the proved-sire records they are encouraging the greatest possible use of breeding stock on which there are data to indicate its breeding worth.

Copy for the third printed list of sires proved in dairy herd-improvement associations, which will include the names and records of 1,348 proved sires whose records were tabulated between April 1, 1938, and April 1, 1939, was prepared for publication.

The 1,348 listed sires had been mated to cows whose average production was 9,078 pounds of milk (testing 4.0 percent fat) and 364 pounds of butterfat. The daughters of these sires had an average production of 8,875 pounds of milk (testing 4.1 percent fat) and 362 pounds of butterfat. Although the sires as a group lowered production slightly, practically all of them would have raised the production level of the average herd in the United States. Only 630 of the sires raised or maintained production in the herd in which they were used. The 718 sires that lowered production were mated to high-producing cows. They probably would have held or raised produc-

tion in lower-producing herds. One of the advantages of the sire-proving program is that the information makes it possible to shift certain sires from herds in which they lowered production to herds in which they can maintain or raise production.

Only 311, or 23 percent, of the sires were reported as alive when the list was compiled. These sires had been mated to dams with an average butterfat production of 374 pounds. Their daughters had an average butterfat production of 387 pounds. The 936 sires that were reported as dead had been mated to dams averaging 361 pounds of butterfat, and their daughters averaged 353 pounds of butterfat. This indicates that as a group the association members had discarded the poorer bulls as soon as their inferiority was suspected and had kept the promising bulls.

IDENTIFICATION AND PRODUCTION-RECORD PROJECT

All States are now cooperating in the identification and production-record project, which was inaugurated several years ago to form the basis for a Nation-wide dairy-cattle breeding program. Not all of the 1,228 association testers have been completely trained to report the necessary records in proper form, but approximately 80 percent are reporting data on some of the herds in their associations. To date the testers have reported the identity of more than 500,000 association animals and more than 270,000 production records, to this Division for permanent recording. These data are used in compiling proved-sire records and herd-analysis tabulations.

GENETIC HERD ANALYSIS

During the year 140 herd-analysis tabulations were compiled, bringing the total to 271 since the work started. Genetic herd-analysis tabulations are compiled for association herds in which 3 or more proved sires have been used. All the data ever reported to this Division and recorded for the individual herd are included in the tabulation. The tabulations are sent to the State colleges, where charts and graphs are prepared to "picture" the results of the analysis for the owner of the herd. With herd-analysis data on his herd the owner has all the available information at hand for evaluating the breeding value of the bulls he had used in his herd and of the various cow-family lines in the herd. He is then in position to select his best cow families and to perpetuate their influence in his future herd.

COOPERATIVE DAIRY-CATTLE BREEDING ASSOCIATIONS

On January 1, 1939, there were 234 cooperative dairy-cattle breeding associations in operation, 68 of which were new associations organized during 1938. These associations had a total membership of 4,383 dairymen, owning or leasing cooperatively 1,112 dairy bulls. Of the 234 associations, 228 were the regular cooperative dairy-bull associations, and 6 were the new dairy-cattle artificial-breeding associations.

The artificial-breeding associations use the technique of artificial insemination primarily to spread the influence of outstanding sires to a larger number of dairy herds. The 6 associations own 33 bulls, which provide breeding service for more than 7,500 cows in the

members' herds. These associations employ competent technicians, usually trained veterinarians, to do the insemination work and manage the affairs of the association.

Cooperative dairy-cattle breeding associations afford an excellent opportunity for extensive utilization of the superior proved sires found in dairy herd-improvement association herds. The bulls can be kept in active service for a longer period than if they are used by individuals, and their inheritance is spread to a greater number of herds. In the past many of the outstanding sires proved in dairy herd-improvement association herds were discarded by the owner long before their usefulness was exhausted, because individual dairymen were reluctant to buy these aged bulls. Some States now have practically a routine procedure for placing such bulls in a cooperative breeding association as soon as they are proved.

DAIRY-FARM-RECORD PROJECT

Since 1937 the Bureaus of Dairy Industry and Agricultural Economics have been cooperating with similar State agencies in obtaining records of the whole farm business of members of dairy herd-improvement associations and in summarizing and analyzing the records so that dairymen generally as well as the cooperating farmers may have information that will enable them to organize and operate their dairy farms more efficiently and therefore more profitably.

During the year, Kentucky, Louisiana, North Carolina, Texas, and Vermont sent in the records of 60 farms for analysis. West Virginia, one of the first States to begin the dairy-farm-record work, forwarded the records of 7 farms the first year. This year approximately 25 members of dairy herd-improvement associations in the State are keeping records of the entire farm business. A summary and analysis is being made of the records of 16 farms in Louisiana and 26 farms in Kentucky. Other studies will be made, and the results published when a sufficient number of records have been received, either from one State, or from several States having the same or similar conditions.

BREEDING, FEEDING, AND MANAGEMENT INVESTIGATIONS

R. R. Graves, *in charge*

THE EXPERIMENTAL BREEDING HERDS AT BELTSVILLE, MD.

BREEDING EXPERIMENTS WITH HOLSTEIN-FRIESIAN CATTLE

The seventh proved sire (Douglas Buttercup Hark) was introduced into the Holstein herd during the year to carry on the project to develop strains pure in their inheritance for a high level of production through the continuous use of unrelated proved sires. The sixth sire died after 6 months of service, leaving only 3 daughters. Chief Piebe Ormsby Burke, the fifth proved sire in the series, is now past 15 years of age but continues an active breeder. He has 31 outbred and 5 inbred daughters in the herd. The first 18 of his daughters to complete production records have a mature-equivalent average of 20,147 pounds of milk and 796 pounds of butterfat.

The entire outbred female group consists of 6 daughters of Varsity Derby Matador, 2 of Pride of the Bess Burkes, 3 of Count Piebe Hengerveld Ormsby, 31 of Chief Piebe Ormsby Burke, and 3 of King Ormsby of Iodak. There are 2 line-bred females in the first line-bred group, sired by Sir Gerben Colantha Rube; 18 in the second line-bred group, sired by Pride Ormsby Gerben Colantha Ona; and 5 in the third line-bred group, sired by Chief Piebe Gerben Colantha Watson. Small groups of daughters by young bulls make up the rest of the herd, which now numbers 96 females, an increase of 7 over last year. Of the total, 46 are outbred, 28 line-bred, and 22 inbred.

Of the 96 females in the herd, 41 have completed production records with a mature-equivalent average of 19,871 pounds of milk and 757 pounds of butterfat. This number includes 26 outbred females, averaging 778 pounds of butterfat; 10 line-bred females, averaging 761 pounds; and 5 inbred females, averaging 642 pounds. These cows are all direct descendants of the foundation herd, which averaged 678 pounds of butterfat; and the increase in herd average can be attributed to the quality of the proved sires used, as no culling has been practiced and the environment has remained uniform since the herd was founded.

A detailed analysis of the foundation herd and of the first outbred generation was published during the year.

BREEDING EXPERIMENTS WITH JERSEY CATTLE

Three sires bred in the Jersey herd have been proved by cooperating dairymen and are now in service in this herd. This restores the project to a proved-sire basis, after a period during which several young sons of former proved sires were used. The herd now numbers 89 females, an increase of 13 during the year. These include 24 in the Owl-Interest group, 19 in the Sophie-Tormentor group, 38 in the Raleigh group, and 8 in the family-crossing project. They are classed as 51 outbreds, 30 line-breds, and 8 inbreds. Thirty-three have completed production records with a mature-equivalent average of 13,632 pounds of milk and 710 pounds of butterfat. The foundation herd averaged 624 pounds of butterfat, and all females now in the herd are the unselected descendants of these foundation cows.

Sixteen cows completed production records during the year, at an average age of 2 years 9 months. Two were mature cows that averaged 16,112 pounds of milk and 857 pounds of butterfat; the other 14 cows (under mature age) averaged 9,940 pounds of milk and 544 pounds of butterfat. The two best records were 17,147 pounds of milk and 956 pounds of butterfat by Sophie Oxford St. Mawes Owlet, a mature cow in the four-family group; and 12,518 pounds of milk and 784 pounds of butterfat by Sophie P. Double Sophie Jewel, a 3-year-old daughter of Sophie's Phoenix.

MISCELLANEOUS BREEDING INVESTIGATIONS

Eighty-four Beltsville-bred bulls are loaned to cooperating institutions and dairymen to be proved in their herds as part of the breeding projects. More and more this proving work is being done in institution herds and in herds belonging to members of bull associa-

tions. Forty of the fifty-five Holstein bulls and 10 of the Jersey bulls are in the herds of institutions or bull-association members.

The Red Danish herd now numbers 35 females. The 8 heifer calves born during the year include 3 inbreds sired by D–501. This bull now has 4 daughters in milk.

A number of females were brought to Beltsville during the year from 4 of the Bureau's field stations for use in a cross-breeding experiment. The herd now includes 11 Holsteins from the Huntley, Mont., station; 12 Holsteins from the Mandan, N. Dak., station; 11 Jerseys from the Lewisburg, Tenn., station; and 15 Guernseys from the Columbia, S. C., station. These are all descendants of the proved sires used at these stations, and most of them have already completed production records. Nine are in calf to the bulls set aside for this project, which include a proved Jersey bull, a proved Holstein bull known to transmit red color, and a partly proved Red Danish bull.

HEALTH AND FERTILITY STUDIES

In the main herd at Beltsville, 156 cows were bred and 85.9 percent conceived; in the tuberculosis unit 46 cows were bred and 95.6 percent conceived. The former were bred by natural mating and required 1.89 services per conception; the latter were artificially inseminated and required 4.26 inseminations per conception. The unusually high ratio of inseminations per conception in the latter herd was due primarily to the low fertility of the semen collected from 2 of the bulls used.

In the artificial-breeding work it was observed that microscopic examination of the semen was not a dependable index to its fertility. Semen from one bull contained motile sperm cells and otherwise appeared normal under the microscope; yet 6.4 inseminations were required for a conception with this semen, whereas only 1.57 inseminations were required with the semen of another bull.

In an effort to find a suitable medium for holding semen at the optimum low temperature long enough to permit its shipment to distant points, refrigeration experiments were conducted to compare the heat-absorbing capacity of olive oil, benzene, celosolve, and a saturated sodium chloride solution with that of water. Olive oil frozen to a semisolid state appears to be the most promising, since it absorbs more heat and appears to be capable of holding a low temperature longer than water.

During the latter half of 1937 an intensive campaign was launched at this station against calf mortality, which was estimated to be between 20 and 25 percent. Since scours in the new-born calves was causing a mortality of approximately 15 percent, the campaign was directed largely against that disease. A hyperimmune antiscour serum for calves was prepared by hyperimmunizing a cow with a bacterin prepared from organisms isolated from the intestinal flora of typical cases of fatal septicemic scours. As a result of the use of this serum and a closely coordinated program worked out between the veterinarian, the herdsman, and the calf-barn attendant both the fatalities and the general incidence of the disease were greatly lowered.

Since these preliminary results were promising, a further effort was made to improve the program by hyperimmunizing the "serum cow"

with a vaccine of live *Bacillus coli* instead of dead organisms in a bacterin. While the cow was being prepared for the new serum production, the Animal Disease Station of the Bureau of Animal Industry furnished 20,800 cubic centimeters of hyperimmune serum for use in the dairy-calf herd. The remaining 4,100 cubic centimeters used during the year was produced exclusively by the dairy-station cow. The calves were given 200 cubic centimeters of the protective serum within 24 hours after birth and additional serum if symptoms of scours appeared.

The death of only one calf during the year was chargeable to scours. This probably represents the lowest mortality rate (0.9 percent) from this disease during any comparable period in the history of the station. It is believed the success of the program was directly due to the use of antiserum and a unified program of sanitation and management. Since this program is, in one sense, an experiment in which no controls are used, there is the possibility that reduced virulence of the casual agent was a factor in lowering the incidence of the disease. With a rise in virulence of the organism, or weakening of the present system, there are still ever-present ample forces ready and capable of creating an outbreak of epidemic proportions.

The calf-scours control program was also conducted in connection with the calf-salvage project in the tuberculosis unit. Only heifer calves are being saved from this unit. They are allowed at least one feeding of colostrum from the dam and are then transferred to the hospital building where they receive antiscour serum injections. After 60 days' observation these calves are given a tuberculin test, and if it is considered negative they are transferred to another barn, where they spend a minimum of 4 months and receive at least two additional tuberculin tests. If at the end of this 6-month isolation period they have passed a minimum of three tuberculin tests, their feet are washed and treated with disinfectant solution and they are immediately released into the main calf barn.

During the year 27 calves were salvaged from the tuberculosis unit. Of these, 19 have been released into the main calf herd, 6 are in isolation quarters, and 1 was slaughtered after reacting to the tuberculin test. One calf in this group, weak at birth, represented the only fatal case of scours at the station during the year.

RELATION OF CONFORMATION AND ANATOMY TO PRODUCING CAPACITY

ANTE-MORTEM AND POST-MORTEM STUDIES

The practice of slaughtering cows that have records of production, and obtaining measurements of conformation, and weights and measurements of the internal organs and body parts has been continued. During the year the Kentucky Agricultural Experiment Station became a cooperator in this work, and the Idaho station discontinued cooperation. Ten reports on cows slaughtered were prepared at the Kentucky station, 8 at Pennsylvania, 2 at Florida, 2 at Georgia, 2 at New Hampshire, 2 at Utah, 1 at South Carolina, and 13 at the Beltsville station—a total of 40 for the year. In addition the New Mexico station has submitted a similar report on a goat—the second prepared at that station. The total number of reports filed to date on cows with records of production is 696. Of this number, 89 were pre-

pared at Pennsylvania, 85 at South Carolina, 48 at New York (Cornell), 39 at Florida, 28 at North Dakota, 23 at North Carolina, and from 2 to 14 at each of 16 other State experiment stations. At the Beltsville station 267 reports have been prepared since the project was initiated.

GROWTH, CONFORMATION, AND UDDER STUDIES

The procedure of obtaining conformation-anatomy-production data on growing heifers and on cows has been continued without material change. In this connection 256 sets of measurements, representing 166 different animals, have been recorded. This brings the total to 3,449 sets on 808 different animals. The frequency of obtaining photographs has been reduced during the year, with the result that only 233 photographs were obtained of 90 different heifers and bulls from birth to 12 months of age.

Emphasis has again been placed on the study of comparative mammary gland development in individual heifers at different ages; the characteristics and performance of the udder during lactating life; and the capacity and anatomy of the udder and the physical properties of its tissues, as determined after slaughter. The number of heifers graded for comparative mammary development was unusually large this year. In all 421 examinations were made which involved 121 different heifers from birth to 18 months of age. Three hundred and ninety-seven examinations of the udders of 84 different cows were also made during the year. Photographs were obtained of the udders of 29 heifers at 18 months of age and of 43 cows of lactating age.

Capacities of excised udders were determined for 16 cows and for 2 heifers. Measured capacities are now on record for 385 udders. Of these, 165 were from lactating cows, 112 from nonlactating cows, 17 from heifers and cows never pregnant, and 57 from calves and heifers. The 34 others were from freemartins and miscellaneous sources. The average capacities are not materially different from those reported in 1938. During the year 26 udders have been preserved with formalin and frozen, 22 have been sectioned and the sections photographed, and studies of the physical properties of the mammary gland tissue have been made of 48. Three udders having unusual histories were shipped from the Bureau's field station at Woodward, Okla., to Beltsville for anatomical study.

INJURY OR INFECTION IN UDDER MAY CAUSE BLIND QUARTERS

The four quarters of a cow's udder develop from entirely independent, tubular formations which are present at birth and remain independent through life, so far as their secretory and ductal systems are concerned. One quarter, therefore, may be injured and its activity completely destroyed, without the others becoming impaired. In fact the remaining quarters may, in certain cases, compensate to a large extent for the loss of the affected quarter. Among the hundreds of udders that have been examined periodically from birth to maturity, a number of cases have been found in which infection of one or more quarters occurred early in life. A study has been made of these cases and the results prepared for publication. Information on this

subject is of importance in view of the fact that in some States and in some cities health authorities do not permit the sale of milk from cows having an inactive quarter, regardless of the cause, and in some areas such cows are not permitted to remain in the herd for breeding purposes.

In nearly every case in which udder infection was found in the calf or young heifer, the affected quarters were abnormal in development for a time, but "filled out" about the same as the unaffected quarters before calving time. After calving, however, it was impossible to obtain milk from the affected quarters and a marked decrease in size of those quarters soon followed. In a number of cases where post-mortem examinations were made it appeared that a fairly abundant development of secretory tissue had occurred but that fibrous or scar tissue had formed in the region of the cistern thereby occluding the passage to the teat canal. It appears, as a result of these findings, that an early infection or injury does not necessarily cause a cessation of the development of mamary gland tissue in the affected quarter, and that milk may be secreted in such quarters at calving time, but that the occlusion of the outlet makes the removal of the milk impossible with the result that involution of the mamary gland tissue in that quarter soon follows.

CANCEROUS GROWTHS RARE IN THE COW UDDER

As a result of studying the anatomy of the udders of more than 400 cows, heifers, and freemartins over a period of several years, various types of lesions have been found. Detailed studies of some of these cases were made during the year and the results prepared for publication.

It is particularly noteworthy that, among the hundreds of udders sectioned in these anatomical studies no lesions have been found that appeared to be cancerous. In fact the work of a number of investigators and the examination of many millions of cattle slaughtered subject to meat inspection by the Bureau of Animal Industry, have led to conclusions that cancer in the udder of the cow is virtually nonexistent—the few cases on record having invaded the udder from carcinoma that originated in the skin. In view of the high incidence of cancer in the mammary glands of humans and of certain other species it is difficult to understand the rarity of the disease in the udder of the cow, especially since that organ is so highly developed functionally, often of enormous size, and may be subjected to friction, irritation, and bruising. A knowledge of its rarity, however, is gratifying in view of the results of experimental work recently performed elsewhere, which indicate that in mice the influence causing breast cancer can be transmitted in the milk of mothers that have an inheritance for a high incidence of breast cancer.

EARLY RECOGNITION OF THE FREEMARTIN CONDITION IN HEIFERS TWIN-BORN WITH BULLS

A study of 17 heifers born cotwin with bull calves was completed and the results prepared for publication. Fifteen of these animals proved to be freemartins. The other two apparently were normal.

A number of characteristics were found to be associated with the freemartin condition, and these are useful in determining at an early

age, whether any individual female born cotwin with a bull calf is likely to be capable of reproduction. Four characteristics which occurred with high frequency in freemartins were: (1) Retarded mammary gland development, (2) the presence of a median fold of skin between the vulva and the navel, sometimes enclosing a cord, which has been referred to as a "rudimentary penis," (3) an abnormal form of mammary gland tissue, and (4) an enlarged clitoris. In some of the freemartins all of these characteristics occurred. In others only one or two could be detected. One or more was found in every one of the 15 cases that proved on autopsy to be deficient in sexual development, but none was found in the 2 that had normally developed internal genitals at the time of death.

FEEDING AND MANAGEMENT INVESTIGATIONS AT BELTSVILLE, MD.

VIABILITY OF SEEDS IN SILAGE

Seeds of various weeds and farm crops were placed in silos with both corn and alfalfa at the time of filling the silos. When the silage was fed out down to the level of the seeds they were removed and dried at room temperature. Germination tests were then made by the Division of Seed Investigation, Bureau of Plant Industry, and all the seeds failed to germinate except a small percentage of *Lespedeza sericea*, bindweed, and in one instance a rather high percentage of the American dragonhead. Some of the *L. sericea*, bindweed, amaranth, sweetclover, and bigseed ladysthumb were hard seeds and were still sound at the end of the germination test. These might have germinated if the test had been continued longer or if the seed coats had been scarified. All of the rest were completely destroyed. Low-moisture alfalfa silage appeared to be slightly less effective in destroying the viability than high-moisture alfalfa silage. Putting crops in the silo instead of making them into hay may be a useful method of combatting weeds that mature seeds at the time the crops are ready to ensile.

SILAGE INVESTIGATIONS WITH SMALL SILOS

Different methods of ensiling crops were tested in small silos (4 feet in diameter by 8 feet high). *Lespedeza sericea* ensiled with 1 percent of liquid phosphoric acid and with 3 percent of molasses seemed to be effectively preserved in both cases; but all the silages were unpalatable, that made with phosphoric acid being the least palatable.

Rye and vetch containing 81 percent of moisture and ensiled with 3 percent of molasses made a fairly satisfactory silage, but the losses of dry matter and protein were excessive. When these crops were ensiled after being dried to 67-percent moisture content the losses of dry matter and protein were reduced, and the palatability was slightly increased, but the loss of carotene was greater.

Alfalfa was ensiled in eight small silos as follows: (1) Fresh green, 70-percent moisture, ¼-inch cut, nothing added; (2) fresh green, 70-percent moisture, ¼-inch cut, 0.8 percent of liquid phosphoric acid added; (3) fresh green, 70-percent moisture, ¼-inch cut, 4 percent of molasses added; (4) fresh green, 73-percent moisture, ¼-inch cut, slow filling to permit heating; (5) wilted, 64-percent moisture, ¼-inch cut,

nothing added; (6) wilted, 63-percent moisture, ¾-inch cut, nothing added; (7) dried to 39-percent moisture, ¼-inch cut, nothing added; and (8) dried to 39-percent moisture, ¼-inch cut, solid carbon dioxide added.

All these silages were very palatable and had a good odor. They were approximately equal in palatability. The silages made from fresh green alfalfa had much more carotene and a little more protein than those made from wilted or dried alfalfa. The dry-matter loss was greatest with the wilted ¾-inch cut and least with the dried alfalfa ensiled with nothing added. There was no apparent advantage in adding solid carbon dioxide. Finely cut silage lost less dry matter and protein than coarsely cut silage. This work shows that good alfalfa silage can be made by a number of different methods. The result of feeding these silages to dairy cows for extended periods remains to be determined.

SILAGE INVESTIGATIONS IN LARGER SILOS

A monolithic concrete silo 14 feet in diameter was filled to a height of 30 feet with first-cutting alfalfa, in six sections from the bottom up, as follows: (1) Fresh green (65-percent moisture) with 3.4 percent of molasses added; (2) fresh green (66-percent moisture) with nothing added; (3) partly dried (47-percent moisture) with nothing added; (4) partly dried (41-percent moisture) with 4.2 percent of molasses added; (5) dried (32-percent moisture) with 4.3 percent of molasses added; and (6) dried (35-percent moisture) with nothing added.

Fresh green material put on above the top section made 4 feet of settled silage, in which the spoilage when the silo was opened in about 6 months was only 3,330 pounds. The total loss of dry matter in the entire silo including that in the spoiled top was 12.32 percent; that in the six experimental sections was 8.85 percent. The sections containing molasses lost 8.45 percent of dry matter and those without molasses, 9.27 percent. There were numerous spots of mold in the two sections of partly dried alfalfa (at moisture contents of 35 to 45 percent), but these did not make up enough of the total to warrant discarding the silage as feed. A similar condition was observed in the previous year's silage. The molasses had little or no effect on the prevalence of these moldy spots.

The silage was fed to milking cows in such amounts as they would eat, and that in each section lasted 20 days. Grain was added to bring the nutrients of the ration up to about the Haecker standard. The average quantity of dry matter eaten per cow per day was 25.9 pounds in the silage made with molasses and 25.5 pounds in that made without molasses. The average decline in milk production by 20-day periods was 6.7 percent when molasses-treated silage was fed and 6.8 percent when untreated silage was fed. The average loss in live weight per cow per period was 6 pounds with the molasses silage and 1 pound with the untreated. Apparently neither variations in the moisture content nor the treatment with molasses significantly affected the feeding value of the silage, but none of the silages had a very high content of moisture.

SILAGE IN SLATTED-FENCE AND PIT-STACK SILOS

Four slatted-fence silos lined with special paper were filled in the spring of 1938 and opened from 56 to 197 days later. Three were five rings high (about 18 feet) and one was four rings high (about 14½ feet). All were approximately 15 feet in diameter. Experience had shown the impracticability of building such silos to a greater height unless special provision is made to keep them plumb. After about 1 month the paper began to show signs of disintegration, and after 2 to 3 months it was in bad condition. Similar paper used in a cooler season the previous year lasted longer.

Orchard grass, pasture grass, and oats were ensiled in the fresh green and wilted stages. The pasture grass was put in slowly to permit heating; molasses was added to a part of the oats in one silo, and weight was applied at the top. The loss of dry matter depended on the time in storage, the height of the silage, and whether or not weight was applied. The least loss (21 percent) was with the weighted silage, and the greatest loss (34 percent) was with the silage that was kept the longest and was in the shallowest silo.

All the silages were eaten rapidly, and there was no great difference in palatability. The wilted oats was eaten in a little larger quantity than the fresh green oats. Molasses failed to improve the palatability of the oat silage.

Silos of slatted fence are practicable for short-time storage of surplus crops but because of the expense of renewing the paper lining each year and the heavy loss of dry matter in the silage they should not be expected to replace more permanent types of silos.

In an attempt to lessen the loss of dry matter in a pit-stack silo, which was 28 percent in 1937, special paper was placed over the stack before it was covered with dirt. The loss of dry matter was 26 percent. It is questionable whether enough silage was saved to offset the cost of the paper.

SILAGE MADE WITH BALED ALFALFA IN A TRENCH

An investigation was made to determine the practicability of baling alfalfa, as might be done with a pick-up baler, and then storing the bales underground; the idea being that, with suitable equipment, baled alfalfa could be put in and taken out of a trench with less labor than unbaled alfalfa. It was not expected that such a practice would be better than chopping the material into a trench nor that it would be feasible if the silage was to be fed to cows individually.

Eighteen bales of fresh green alfalfa (4,210 pounds) and 18 of partly dried alfalfa (3,630 pounds) were buried in a trench. The spoilage on the top and around the sides at the top was considerable, indicating the imperfect exclusion of air. The unspoiled silage was of good quality and as palatable as most silages, but not as palatable as No. 2 leafy alfalfa hay. The silage made from the partly dried alfalfa was more palatable than that made from the fresh green alfala.

Although it appears that, by using larger quantities of alfalfa and more thoroughly excluding the air, alfalfa silage can be made in bales without excessive loss from spoilage, the method does not seem sufficiently promising to warrant further attention, at least at present.

BALED-STRAW SILO

A silo 14 feet inside diameter by 16 feet high was constructed of 12,740 pounds of baled straw surrounded by wire hoops. This was filled with corn, and after 30 days the silage was fed out. All the straw except that in the bottom tier of bales was used for bedding. Air filtered in, through and between the bales, resulting in a layer of moldy silage next to the wall and brown silage next to the mold all the way down. The carotene in the upper half of the silage was nearly all destroyed. The loss of dry matter was 20 percent—about twice as much as the loss in 30 days in a snow-fence silo the year before. The wall of the straw silo was very uneven because in laying one tier of bales above another the joints were broken. As the silage settled it left pockets along the wall. The wall of a silo with a larger diameter would be less irregular, and probably the loss of silage would be reduced. It is concluded from this work that baled straw does not make a satisfactory silo.

LOSSES IN THE FIELD CURING OF HAY

First-cutting alfalfa hay, which was sun-dried in clear weather without loss of leaves for 24 hours in the swath and for 5 hours more in the windrow to a moisture content of 22 percent, lost no dry matter either in the swath or windrow; but the losses of protein and carotene were 6 and 55 percent, respectively, in the swath, and 9 and 65 percent, respectively, in the swath and windrow.

Second-cutting alfalfa hay similarly dried for 5½ hours in the swath and for 24 hours more in the windrow to a moisture content of 19 percent, lost dry matter, protein, and carotene to the extent of 4, 3, and 17 percent, respectively, in the swath, and 10, 12, and 61 percent, respectively, in the swath and windrow.

Although there is a satisfactory agreement between the two experiments with respect to the loss of protein and carotene, the same cannot be said with reference to the dry matter. Many more experiments should be made in order to average out errors in sampling; also to determine the influence of unfavorable curing conditions.

PASTURE INVESTIGATIONS

Two legumes—crimson clover and hairy vetch—were sown in the fall on a permanent pasture of Kentucky bluegrass to improve the grazing in the late fall and early spring and to provide the nitrogen needed by the grass during its actively growing period.

The yield of crimson clover was somewhat more on the seeded plots than on similar unseeded plots, and the increases in the yield were greater on fertilized than on unfertilized plots. Furthermore, there was a substantial increase in the growth of the grass following crimson clover. The weather at the time of seeding and the date of seeding appeared to be the most important factors affecting the stand and yield.

The hairy vetch, which was seeded September 15, reached a height of 8 to 10 inches late in October and was grazed off. In the spring the vetch made a luxuriant growth. Representative strips of the

vetch mowed at intervals of 1 week from April 24 to May 29 showed, consistently, dry-matter yields much in excess of similar strips of unseeded pasture grass. In the latter part of May the yield of dry matter in the vetch was 4,090 pounds per acre as compared with 1,060 pounds in the pasture grass or nearly four times as much. The strips mowed after May 1 made but little regrowth; also the heavy growth at the later stages tended to smother out the pasture grass. The vetch was quite palatable when grazed at a height of 8 to 10 inches and was eaten readily later as a soiling crop, although there was a decline in palatability as it approached maturity. Problems still to be solved are how best to make use of the high-yielding character of the vetch and still not injure the pasture grass, also how best to graze the vetch and at the same time secure reseeding.

INPUT-OUTPUT INVESTIGATION

The study of the relation of input to output in milk production, which is being conducted in cooperation with the Bureau of Agricultural Economics and 10 State experiment stations under a Bankhead-Jones grant, will be continued another year since the 2 years' results failed to show conclusively the point or level of feeding the cows at which diminishing returns may be expected. Apparently this point will depend on the inherent ability of the cows to produce milk and on the distribution of the feed throughout the year. Good cows will respond in milk production to increasing quantities of feed better than poor cows; light feeding in the first part of the lactation period and heavy feeding in the latter part of the lactation as well as during the dry period (a rather common practice) may lessen the returns per unit of additional nutrients consumed. Yet in view of the facts that nutrients are cheaper in some feeds than in others and that the cheaper feeds make up most of the ration in the latter stages of lactation and during the dry period, it is possible that light feeding early in lactation and heavy feeding later may be the most economical practice. It is expected that the second year's work, still to be analyzed, and the third year's work will provide information on the most economical distribution of nutrients as well as on the most economical quantity of total nutrients.

WORK AT THE FIELD EXPERIMENT STATIONS

GENERAL

A dairy project was started at the Coastal Plain station, Willard, N. C., in cooperation with the North Carolina Department of Agriculture and the North Carolina Agricultural Experiment Station, to conduct breeding investigations and to study dairy-cattle feeding and management problems peculiar to the Coastal Plain region. Construction of dairy barns and other buildings was nearing completion at the end of the year. A tract of land was set aside for growing feed crops for the herd. A grazing experiment was outlined, and preliminary work started on a series of plots that will be seeded, largely to annual grazing crops. It is hoped that a series of crops can be

grown that will, in conjunction with permanent pasture, furnish year-around grazing. Twelve Jersey heifers with several proved-sire crosses in their inheritance were purchased to enlarge the breeding herd. The breeding experiment in the main will be conducted as at the other field experiment stations.

On June 30, 1939, the 8 field stations had a total of 460 dairy cattle (403 females and 57 bulls). This number was only 28 less than on the same date last year despite the fact that sharp reductions were made in most of the herds. Of the 403 females, 209, or approximately 50 percent, are less than 2 years of age. In addition, 125 bulls born in these herds are lent to cooperators in the vicinity of the stations, where they are being proved for their ability to transmit the inheritance for high levels of milk and butterfat production.

Several of the cooperators have used Government-owned bulls (sons of proved sires) for many years, and as a result of this breeding program their present herds represent an accumulation of several generations of valuable inheritance. There are approximately 4,173 females of breeding age in the herds of the present cooperators. Table 1 shows the number of present cooperators by stations, the number of females of breeding age in their herds, and the number of Government-owned sires they have used in their herds to date. One cooperator near the Huntley, Mont., station is now using his fourteenth sire, and one is using his tenth. Many of these bulls were used concurrently in these herds.

TABLE 1.—*Number of present cooperators, females of breeding age in their herds, and Government-owned sires they have used*

Station	Present cooperators	Females of breeding age in cooperators' herds	Cooperators that have used—										
			1 sire	2 sires	3 sires	4 sires	5 sires	6 sires	7 sires	8 sires	9 sires	10 sires	14 sires
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Huntley, Mont.	44	1,700	11	8	6	3	5	2	4	1	2	1	1
Woodward, Okla.	14	620	5	4	1	1	1	1	1				
Mandan, N. Dak.	16	542	2	5	5	3	1						
Jeanerette, La.	2	150		1				1					
Columbia, S. C.	14	555	7	3	2	1	1						
Lewisburg, Tenn.	18	537	14	2	2								
Hannibal, Mo.	17	269	12	1	3	1							
Total	125	4,173	51	24	19	9	8	4	5	1	2	1	1

Ninety-one official records were made in the field-station herds during the year, the largest number completed during any fiscal year (table 2). The test cows are kept either in stanchions or in pen barns, depending on the type of barn at the particular station, and milked three times a day, except at Jeanerette, where they are milked only twice a day. These records are not selected. Every heifer that freshens is tested unless she is in poor health.

TABLE 2.—*Official records made at each field station, the average age of the cows when the records were made, and the mature-equivalent production,*[1] *1939*

Station	Official records	Average age		Actual production			Mature-equivalent production	
				Milk	Butterfat		Milk	Butterfat
	Number	*Years*	*Months*	*Pounds*	*Percent*	*Pounds*	*Pounds*	*Pounds*
Huntley, Mont.	12	2	8	10,604	3.79	402	13,467	511
Woodward, Okla.	11	2	6	14,009	3.65	511	18,072	659
Mandan, N. Dak.	17	2	3	13,331	3.46	461	17,997	622
Jeanerette, La.	4	2	8	7,391	5.07	376	9,313	463
Columbia, S. C.	13	3	11	8,775	5.30	465	9,565	507
Lewisburg, Tenn.	18	2	8	8,627	5.26	454	10,870	558
Hannibal, Mo.	16	2	10	7,097	5.72	406	8,800	491
Total or average	91	2	9	10,115		445	12,796	355

[1] The cows were milked 3 times a day at all stations except Jeanerette, where they were milked only twice a day.

At the several field stations a total of 101 cows have been fed on roughage alone and the animals have made 134 lactation records that average 9,525 pounds of milk and 358 pounds of butterfat (mature-equivalent basis). The same cows on a full-feed ration (grain liberally fed in addition to roughage) averaged 14,662 pounds of milk and 558 pounds of butterfat (mature-equivalent basis). Their production on roughage alone was approximately 65 percent of their production on the full-feed ration.

A manuscript presenting the results of four calf and heifer feeding experiments at the Huntley, Mont., Lewisburg, Tenn., Woodward, Okla., and Jeanerette, La., stations was prepared for publication.

The breeding records of the station herds were analyzed from the standpoint of (1) the relationship of the number of pregnancies or calvings to the number of services required per conception and (2) the effect of age at first breeding on the number of services required per conception. A total of 4,040 services resulting in 1,686 pregnancies were tabulated and studied. Heifers required on the average 3.20 services per conception for their first calving, as compared to 2.06 services for later calvings as cows. This was 55 percent more services per conception for the first calving.

Age of heifers at the time of first breeding had no significant effect on the number of services required per conception.

HUNTLEY, MONT., STATION

The experiment to determine the effect on the yield, on the stand, and on the feeding value for dairy cattle, of cutting alfalfa hay at different stages of maturity was completed last year and the results have now been prepared for publication.

Three cows are on a feeding experiment in which they receive alfalfa hay and silage at will throughout the lactation period, and a limited amount of grain at certain stages of the lactation. On this ration, one cow recently completed a 365-day record of 12,963 pounds

of milk and 415 pounds of butterfat at 7 years of age, which is approximately 75 percent as much as she produced at 3 years 6 months of age under full-feed conditions (1 pound of grain to each 3 pounds of milk produced). In two 365-day lactation periods on alfalfa hay alone this same cow had averaged 9,061 pounds of milk and 310 pounds of butterfat (mature-equivalent basis), or approximately 70 percent as much milk and 74 percent as much butterfat as she produced on the hay, silage, and limited grain ration of the present experiment.

A total of 126 sires from this station have been loaned to cooperators since this project started; and 84 of these sires now have 1 or more daughters with production records that can be compared with the dams' records. The 939 daughters of these sires have 1,331 records that average 11,157 pounds of milk and 406 pounds of butterfat (mature-equivalent basis), and the dams of the daughters have a total of 1,649 records that average 10,227 pounds of milk and 364 pounds of butterfat. This represents an average increase by the daughters of 930 pounds of milk and 42 pounds of butterfat. The daughters of 64 sires exceeded their dams in milk production, the daughters of 56 sires exceeded their dams in butterfat test, and the daughters of 69 sires exceeded their dams in butterfat production.

WOODWARD, OKLA., STATION

Four cows completed a 365-day lactation period on an experiment in which they received alfalfa hay and silage at will throughout the lactation, and a limited amount of grain at certain stages of the lactation. These four cows averaged 14,899 pounds of milk and 565 pounds of butterfat, at an average age of 4 years 1 month, or 16,311 pounds of milk and 619 pounds of butterfat on a mature-equivalent basis. This is 82 percent of their milk production and 84 percent of their butterfat production on official test under full-feed conditions.

A grazing experiment to compare the palatability of eight different varieties of sweetclover was conducted in cooperation with the Bureau of Plant Industry. Each variety was seeded in a strip 160 inches wide for the length of the field, and grazing observations were made, to compare the palatability of the different varieties with the common white variety. The cows seemed to prefer the smaller, earlier-maturing varieties.

A 5-acre field of alfalfa yielded at the rate of 2.33 tons per acre, and the cost per 100 pounds of total digestible nutrients was 35 cents. Another 14-acre field yielded 1.33 tons per acre and in addition furnished 39 cow-days of grazing per acre. The estimated cost of producing 100 pounds of total digestible nutrients in this field was 29 cents. These costs do not include the original seeding costs. Nine acres of oats cut for hay yielded 1.36 tons per acre at a cost of 43 cents per 100 pounds of total digestible nutrients, and Sudan grass cut for hay yielded 1.76 tons per acre at a cost of 50 cents per 100 pounds of total digestible nutrients. Thirty-nine acres of sorgo cut for silage yielded 4.02 tons per acre. The cost per ton of silage was $2.58, and the cost per 100 pounds of total digestible nutrients was 86 cents.

MANDAN, N. DAK., STATION

As a whole, the crop yields on the station farm were rather disappointing, the yields for corn silage and oats falling below the 10-year average (1928–37). Forty-four acres of Victory oats yielded at the rate of 19.7 bushels per acre, as compared with a 10-year average of 22.2 bushels. Forty-four acres of Trebi barley yielded at the rate of 19.7 bushels per acre, as compared with a 10-year average of 17.2 bushels. The cost per 100 pounds of total digestible nutrients was 75 cents for the oats and 56 cents for the barley. The main factor contributing to the low yields was an extremely bad grasshopper infestation. Poison was spread four times during the season and was fairly beneficial in killing the local grasshoppers, but others came in from the surrounding country.

A 33-acre field of Rainbow flint corn harvested for silage with a silage harvester yielded at the rate of 3.2 tons per acre, as compared with a 10-year average of 3.4 tons. The cost per 100 pounds of total digestible nutrients was 53 cents. Sudan grass cut for hay yielded 1,814 pounds per acre at a cost of 45 cents per 100 pounds of total digestible nutrients.

A new pit silo (14 by 21 feet) was constructed last fall. Metal lath was nailed to pegs in the earth, and the silo was plastered. The 495 hours of man labor used cost $180.12. The unskilled labor was paid at the rate of 37½ cents per hour; skilled labor (plastering), 62½ cents. The materials included sand, gravel, metal lath, rope, nails, and blasting powder and cost $97.31. In addition gasoline and oil for the tractor amounted to $5.04, making the total cost of the silo $282.47. This silo has an estimated capacity of approximately 60 tons, and the construction cost was $4.71 per ton of capacity. It is pointed out, however, that the wage rate paid was considerably higher than would be paid farm labor. Most of the work could be performed by regular farm labor.

Friend Ona Paul Colantha, the fourth consecutive proved sire used in the Mandan herd, now has 18 daughters that have finished their first-calf official records. Calculated to a mature basis, the 18 records average 17,885 pounds of milk, 3.46 percent of butterfat, and 618 pounds of butterfat. The 18 dams averaged 17,589 pounds of milk, 3.46 percent of butterfat, and 611 pounds of butterfat (mature basis). This sire was bred at the Huntley, Mont., station and was proved in a cooperator's herd in Wyoming.

JEANERETTE, LA., STATION

Two years ago a series of experiments was started to find out the best means of reestablishing white clover in the pasture plots. For several years the stand of white clover had been gradually diminishing, and undesirable grasses had been encroaching. The Division of Forage Crops and Diseases, Bureau of Plant Industry, was consulted as to the type of experiments that would be most effective.

One experiment was to test the value of the application of lime and phosphorus on the plots without any preparation of the land or seeding to white clover. Lime (oystershell) was applied at the rate of 1 ton per acre and superphosphate (18-percent) at the rate

of 200 pounds per acre. Both the lime and superphosphate were disked in. One half of each plot was used as a check, that is, it received no application of lime or superphosphate. For the first year, the treated plots yielded at the rate of 3,695 pounds of cured hay per acre and the check plots at the rate of 2,796 pounds, an increase of 899 pounds, or 32 percent, from the treated plots.

Another plot consisting of 3.17 acres was given a similar application of lime and superphosphate, and was plowed and seeded at the rate of 10 pounds of white clover per acre. This plot yielded 3,048 pounds of cured hay per acre, as compared with 2,863 pounds for the check plot, which was fertilized and limed in a similar manner but was not plowed or seeded. This represents an increase of only 185 pounds, or 6 percent, in favor of the seeding.

Another plot was given an application of superphosphate and plowed and seeded. No lime was applied. It produced 2,897 pounds of cured hay per acre as compared with 1,520 pounds for the check plot, which was fertilized in a similar manner but was not plowed or seeded. This was an increase of 1,377 pounds, of 91 percent, due to seeding.

Another plot was given an application of lime but no superphosphate. It was plowed and seeded, and the yield was 3,835 pounds of cured hay per acre as compared to 1,845 pounds for the check plot, which was limed but was not plowed or seeded. This was an increase of 1,990 pounds, or over 100 percent, due to seeding.

A plot of 3.35 acres was given an application of lime and 5 tons of manure per acre; but no superphosphate. It was plowed and seeded, and the yield was 4,686 pounds of cured hay per acre as compared with a yield of 5,398 pounds for a check plot that received similar treatment except that it was not plowed or seeded. Seeding in this case apparently resulted in a decrease of 712 pounds of cured hay per acre.

Observations on plant growth showed that in all cases the seeded plots had a much better stand of white clover than the unseeded plots. While some of the above results are somewhat contradictory as judged by yields of cured hay per acre, these represent only the first year's results. This experiment is being continued.

During the 1938 season, 66.6 tons of dried hay were cured in the rotary-type hay drier. This consisted largely of clovers and grasses with some alfalfa. The drier had a capacity of 2,047 pounds of green material or 865 pounds of dried material per hour of operation. The water evaporated per hour of operation was 1,182 pounds. The cost of operating the drier was $7.70 per ton of dry hay.

The proved Jersey sire Tiddledywink Fauvic Actor 288046, because of an injury to his hip, is unable to serve; so artificial insemination is being used in an effort to keep him in use. This sire was dropped at the Beltsville, Md., station and was loaned to the University of Tennessee, where he was proved. He has 12 daughters in the university herd that average 13,195 pounds of milk and 671 pounds of butterfat. This bull has sired 13 females in the Jeanerette herd, 10 of which are alive.

COLUMBIA, S. C. (SAND HILL), STATION

The results of the experiment on the carrying capacity of the permanent pasture and the use of several annual grazing crops, which

has been in progress for several years, were prepared for publication in cooperation with the South Carolina Agricultural Experiment Station. This experiment was reviewed and summarized in last year's report. The experiment is being continued in an effort to extend the grazing season with crops that are the most economical to grow under the conditions prevailing at this station.

Breeding troubles have increased in the herd, particularly with first-calf heifers. First-calf heifers are being bred to young sires in an effort to get them to conceive more promptly. Saugerties Royal Sequel 159031, the present proved herd sire, is 11 years of age and still in active service. He has sired 38 animals in the station herd (17 females and 21 males). Several of his daughters have been bred, and several of his sons are loaned in cooperators' herds where they will be proved.

An experiment was carried out to determine the difference in time involved in milking the herd of 26 cows (3 times a day) with the combine milker by using 2 units instead of 3 units. The average total milking time was 53 minutes 58 seconds with 3 units and 1 hour 7 minutes 40 seconds with 2 units, or 13 minutes 42 seconds longer when only 2 units were used.

Additional farm land was purchased for the station, primarily for growing feed crops for the dairy herd.

LEWISBURG, TENN., STATION

In the experiment started in 1932 to compare the production of Jersey cows for entire lactation periods on roughage alone (machine-dried hay and pasture) and on full feed (machine-dried hay, pasture, and 1 pound of grain for each 2.77 pounds of milk produced) 26 cows have now completed 30 lactation-period records on roughage alone. These cows were all milked 3 times a day, and the average lactation period was 356 days. On roughage alone they made 30 records that average 6,742 pounds of milk and 344 pounds of butterfat (mature-equivalent basis); on full feed the same cows had made 26 records that average 9,891 pounds of milk and 524 pounds of butterfat (mature-equivalent basis). They produced 68 percent as much milk and 66 percent as much butterfat on roughage alone as they produced on full feed. The hay was dried in a rotary-type drier and consisted of approximately 40 percent of alfalfa, 24 percent of soybean, and 36 percent of miscellaneous hays, which included pasture grasses and small batches of clovers. Chemical analyses of all hay samples indicated a crude-protein content of approximately 14 percent and a crude-fiber content of about 29 percent. Kentucky bluegrass has been predominant in the pastures, though Bermuda grass and other grasses are found in varying amounts.

Some preliminary experiments were carried out on ensiling grasses and legumes in stack silos and small combination trench stacks. In one experiment a shallow pit 8 feet wide, 30 feet long, and 3 feet deep was dug and filled with 40 tons of a mixture of bluegrass, orchard grass, redtop, white clover, hop clover, crimson clover, hairy vetch, and Austrian Winter peas. The material was ensiled in the long state, and no molasses or acid was added. The moisture content varied from 21 to 61 percent. Some of the loads were almost

dry enough for hay. Tractors were used to pack the ensiled material, which extended 3 feet above ground. It was then covered with the dirt that had been removed from the trench, and stones were placed on top to give additional weight. This silage kept very well; there was some spoilage above ground near the top and around the edges but none below the ground level. The cattle ate the silage readily. It required a total of 21.8 man-hours, 6.5 horse-hours, 1.85 truck-hours, and 1.72 tractor-hours of labor to dig the trench, fill it, and cover the silage with dirt. At prevailing wage rates the total cost amounted to only 25 cents per ton of green material ensiled.

Five tons of crimson clover was ensiled in a smaller trench-stack silo in the field. Molasses was added at the rate of 95 pounds per ton of clover, and the clover averaged 66.8 percent of dry matter. There was a spoiled layer of silage 4 to 6 inches thick around the sides above ground, but none below the surface. The silage was of good quality and was well liked by the cattle.

Eight tons of Korean lespedeza placed in a stack proved a total loss. The dry-matter content ranged from 50 to 63 percent. No molasses was added. In another experiment 35 tons of a mixture of alfalfa (rather mature), crabgrass, and weeds was placed in a stack, with no trench. No molasses was added, and the moisture content ranged from 40 to 60 percent. The material was well tramped, and the stack was 18 feet high when completed. A small amount of mold was present in the silage, extending in for 3 feet from the sides. A small part of the top was spoiled. The cattle ate the silage readily.

It would appear that there is considerable advantage in utilizing temporary silos of this type in some localities. They are inexpensive to construct, no filling machinery is needed, and they can be constructed in the field where the crop is produced.

The practice of seeding crimson clover and other legumes on pasture grass sod each fall, for the purpose of producing some winter and early spring grazing, continues to be successful, though the very dry weather during the fall of 1938 resulted in the poorest stands of crimson clover in several years.

HANNIBAL, MO., STATION (THE HATCH FARM)

Considerable attention was given to the use of short-wave diathermy for the treatment of mastitis and the results are proving quite effective. A portable low-power machine, equipped with special pads for treating cow's udders, is used. The machine weighs 25 pounds and can be plugged into a standard light socket. The usual length of treatment is 1 hour. A total of 63 infected animals in 3 herds have been treated. The cases were of varying intensity. Several were of several years' duration and the milk was unfit for use. Some of the animals received more than 40 treatments. The Hotis test for mastitis was used as a check in all tests. No ill effects from the treatments have been observed, and preliminary results indicate that most cases can be arrested or cured and the cows restored to reasonable production if the treatments are continued long enough. This work is being continued, and the results will be carefully verified.

Two alfalfa fields continue to yield heavily. One field of 5 acres, seeded in the fall of 1935, produced 6.98 tons of field-cured hay per acre in 1938. In 1937, which was the first full cropping year, the field produced 5.46 tons of field-cured hay per acre. Cost records for the 3 years (1936–38) that this field has been in production show that the hay was produced at a cost of $3.38 per ton. This figure includes 75 percent of the original seeding cost but does not include use of the land. Another field of 7.3 acres seeded in 1936 yielded at the rate of 6.18 tons per acre at a cost of $2.89 per ton.

A progress report of the station's work to date is being prepared for publication. This will include the results of the pasture-fertilization project which has been in progress for several years.

Progress Owl's Pilgrim 319668, the fourth successive proved sire used, is still in active service in the herd. He has sired 25 females in the herd, 21 of which are alive. The oldest daughters are now of breeding age.

Four cows have completed eight lactation-period records on roughage alone (alfalfa hay, silage, and pasture), averaging 8,249 pounds of milk and 396 pounds of butterfat (mature-equivalent basis). On full feed (roughage and a liberal allowance of grain) the same cows averaged 12,310 pounds of milk and 634 pounds of butterfat (mature-equivalent basis). Their production on roughage alone was 65 percent as much milk and 61 percent as much butterfat as they produced on full feed. One cow showed rather remarkable persistency during two consecutive lactation periods on roughage alone. In the first 365-day lactation she produced 10,814 pounds of milk and 550 pounds of butterfat, then she was dry for 103 days, and in the next lactation period produced 10,625 pounds of milk and 519 pounds of butterfat.

COOPERATIVE WORK AT THE UTAH AND WESTERN WASHINGTON EXPERIMENT STATIONS

In 1938 a group of surplus cows from the Huntley station was loaned to the Utah Agricultural Experiment Station for breeding experiments. These cows were the result of a number of generations of proved-sire matings in the Huntley herd and were carrying calves by proved sires.

A number of bull calves were dropped by these cows, and the Utah station is organizing breeding associations in which artificial insemination will be practiced, in order to obtain a maximum distribution of the superior germ plasm these bulls are believed to possess.

At the Western Washington Experiment Station a 3-year study of the changes that take place in the composition of pasture herbage during the grazing season has been completed. It was found that the dry-matter content of the pasture herbage was highest during the middle of the summer; that the crude-protein content increased gradually throughout the pasture season; that the nitrogen-free extract and crude-fiber content showed an opposite trend from that of the crude protein; that the ether extract remained at a rather constant level throughout the season except for an increase in the last grazing period; that the calcium content was higher during the periods of higher temperature and lower rainfall; and that the phosphorus content remained at a rather constant level throughout the season.

The results of a 2-year experiment in which the milk-production value of alfalfa hay grown in the Yakima Valley was compared with that of locally grown grass hay and silage, when these roughages were fed as the entire ration during the winter period, are being prepared for publication. Though the crude-protein content of the alfalfa hay was much greater than that of the grass hay and silage and the consumption of dry matter in the alfalfa-hay ration was also much greater, the average daily milk yield for the 2 years was 92 and 96.7 percent as great, respectively, on the grass hay and silage ration as on the alfalfa-hay ration.

DIVISION OF NUTRITION AND PHYSIOLOGY

C. A. Cary, *acting in charge*[1]

RELATION OF VITAMIN E TO NUTRITIONAL PARALYSIS

When rabbits are fed a cow ration consisting of a grain mixture and a poor-quality hay such as U. S. No. 3 alfalfa, and are also fed small amounts of cod-liver oil (1 milliliter daily), they eventually become paralyzed due to a degeneration of their skeletal muscles (muscular dystrophy). When U. S. No. 1 alfalfa hay is fed in place of the poor-grade hay no such condition develops, unless the good-quality hay has been previously extracted with a fat solvent like ether or petroleum ether; and in this case the material in the extract may be used to cure the paralysis.

Wheat-germ oil is also effective in curing this paralysis. Other laboratories have shown that vitamin E made from wheat-germ oil would cure paralysis of this sort in rats and rabbits and this was confirmed. This Division showed further that synthetic alpha-tocopherol (synthetic vitamin E) itself was effective. Six rabbits suffering from muscular dystrophy, but still able to walk with difficulty, were given the synthetic material in single doses, varying from 17 to 65 milligrams. All were cured except the one receiving the 17-milligram dose; whereas experience in this Division would indicate that invariably within 24 hours each of these animals, if left untreated, would have been unable to stand or consume food and would eventually have died from this condition. This work was done under a grant from the Bankhead-Jones funds, and a preliminary note on it is in press.

PHYSIOLOGY OF REPRODUCTION AND LACTATION

Studies of the physiology of reproduction and lactation are carried on in cooperation with the Bureau of Animal Industry under a grant from the Bankhead-Jones funds.

The presence of male hormone in the urine of rams was confirmed, but the methods of preparing extracts for assay are still too imperfect to afford accurate estimations of output by bioassay. Papers were published during the year giving the results of studies of (1) the occurrence of androgen in cattle urine; (2) the chemical nature of the androgen in bull urine; and (3) the effect of exposure to light and of the seasons of the year on the response of the capon's comb in the assay of male hormone.

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[1] E. B. Meigs, Chief of the Division, is on an indefinite leave of absence.

A simple method for the differentiation of the basophilic granules in the cells of the anterior pituitary has been worked out and published. As pointed out last year, evidence was obtained of a second type of basophilic cells in the anterior pituitary of cattle. A preliminary paper was published on these results and also one on the effect of castration on the basophilic cells of the bovine anterior pituitary, with consideration of the freemartin.

To determine the distribution of the gonad-stimulating hormone and of the basophilic and acidophilic cells in different parts of the anterior lobe of the pituary gland, the glands of 24 beef steers, 2 or 3 years old, were obtained within 10 minutes after the death of the animals and were immediately frozen. The glands were dissected into three parts—in one of which about 75 percent of the glandular cells were basophilic, in another 30 percent, and in a third 10 percent. The gonad-stimulating hormone content ran roughly parallel with the percentage of basophilic cells. The prolactin (milk-producing hormone) content of these glands, however, was fairly evenly distributed. These limited data suggest that the acidophilic cells are possibly not exclusively responsible for the production of prolactin. The procedure for the extraction of prolactin was standardized, and consistent yields may be expected from glandular material.

With the methods in use in this laboratory, the yield (activity) of gonad-stimulating hormone from cattle pituitaries has been 12 to 15 times that reported by other workers. Even when the dry material is stored in stoppered containers in an ice box, the activity shows signs of deterioration—about 50 percent in 8 weeks. The deterioration was less when the material was stored under acetone.

Preliminary extractions of rabbit pituitary glands showed them to be fully as potent as cattle glands for the lactogenic hormone. In the rabbit the gonad-stimulating hormone of the pituitary is discharged after coitus. To determine whether the gonadotropic activity and the lactogenic activity are due to separate and distinct hormones, work is in progress to determine whether or not a change occurs in the lactogenic material in the pituitary gland simultaneously with the discharge of the gonadotropic hormone.

Hypophysectomized rats (i. e., rats with their pituitaries removed) do not secrete milk. When anterior pituitary extract, adrenal cortical extract, and liberal quantities of sugar are supplied, lactation results, but the young cannot suckle and invariably die. This Division showed that this method of therapy, plus administration of posterior pituitary extract, enables hypophysectomized mothers to rear their young successfully. A preliminary report on this work was published.

In the assay of prolactin, the dose-response curve is not the same for crude rabbit pituitaries as for purified prolactin, and in this respect the rabbit pituitary extracts behave very much like beef extracts. As with the beef extracts, the response falls off markedly from the Riddle curve at low concentrations, making the potency of the extract appear lower than it would appear in response to higher concentrations. As with crude beef pituitary, there is also no difference in the response to intramuscular or subcutaneous injections. These results differ from those obtained by Riddle with purified preparations.

MATERIALS IN PLANTS AFFECT REPRODUCTION IN MAMMALS

As is well known, the anterior lobe of the pituitary gland secretes a hormone that affects the functioning of the gonads, that is, it will bring about ovulation in the rabbit. Material having this same effect has been discovered in plants, in another laboratory, and with Bankhead-Jones funds this Division began work with plant materials. Various methods of extracting and purifying this material from plants were tested out. Preparations were made, of which less than 60 milligrams produce ovulation when injected into the rabbit. These preparations are, undoubtedly still very impure. From the best plant juice so far examined (from immature oat plant) one ovulating dose has been obtained per one-half ounce of juice. Besides producing ovulation in the rabbit, the material produces marked ovarian stimulation when injected into immature rats. The material is quite unstable and work is necessary to determine the conditions affecting its stability.

Copper salts have been shown elsewhere to augment the activity of the gonadotropic hormone and to stimulate ovulation in rabbits. This Division found that 3.5 milligrams of copper, either as the acetate or sulfate, produces ovulation in the rabbit and that this action can be blocked by previously treating the rabbit with adequate doses of progesterone (the hormone from the corpus luteum). It is also known that progesterone prevents ovulatory response to coitus in the rabbit, but does not prevent the response to the injection of pregnancy urine extract which contains a gonad-stimulating material similar to that secreted by the anterior lobe of the pituitary gland.

Plant juices contain copper, and the above results are being used in a study to throw light on the mode of action and nature of the gonad-stimulating material in plants. Thirteen animals were injected with copper salts after each had received a daily injection of 2 milligrams of progesterone for 3 days: only two ovulated, and the responses were subnormal. Five animals that were similarly treated with progesterone were given an injection of 1.6 times the minimal effective dose of oat extract, and all five ovulated. Further evidence is necessary, but apparently the plant product works physiologically directly on the ovary as does the pituitary gonad-stimulating hormone itself, and not through the pituitary as does copper (and coitus).

Recently a cooperative investigation of various plant juices was undertaken, in which the Bureau of Plant Industry grew the plants and expressed the juice from them at a stage physiologically comparable with that of the oat plant used in the above work The units of activity per liter of juice were as follows: Sudan grass, 25; corn plant (whole), 20; and feterita, 16. The corn plant (stem only), kidney bean, brown corn, sorghum, and soybean leaves were inactive.

GROWTH FACTOR IN CASEIN AND LIVER EXTRACT

Further work was done on the chemical and physiological properties of the unidentified growth factor that is present in certain caseins and in the liver extract that is used in treating pernicious anemia. This factor is undoubtedly different from vitamins A, D, and E. It is apparently different from the B vitamins, that is, the water-

soluble vitamins in yeast including nicotinic acid. Its concentration in yeast, if present at all, is very low.

In addition to promoting growth, this or a similar factor has been reported to affect lactation. The study of this factor is important also in relation to the biological assay method for vitamin A, since a deficiency of it in the casein used in the basal ration may seriously affect the accuracy of the test.

A deficiency of the factor in the diet of rats is manifested by the animals "plateauing" in weight under certain conditions at levels considerably below the normal adult weight. Recent work indicates that rats, at least males, when placed even at weaning time on a diet deficient in the factor, show a subnormal rate of growth during the first 6 weeks; this fact may aid materially in shortening the time required for assaying various materials and fractions for the factor.

CAROTENE REQUIREMENTS FOR NORMAL CALVING

In the experiment to determine the carotene requirements for normal calving, 23 cows have now calved on rations of known carotene content. Seven of these cows received 86 to 132 milligrams of carotene daily in their feed, and their 7 calves were normal at birth. Eight cows received 31 to 60 miligrams of carotene daily. Five of their calves were dead at birth or died soon thereafter; 1 was very weak, but it was given cod-liver oil and survived; 1 was slightly weak, and its vision was impaired; and only 1 was normal. The mother of the normal calf had received pasture up to 7 months before the calf was born. Also, 8 cows received 61 to 83 milligrams of carotene daily. Four of their calves were normal at birth, 3 were slightly weak, and 1 was definitely weak. It is obvious that, to obtain a normal calf, a feeder should aim to feed 80 milligrams or more of carotene daily to a pregnant cow for some time (still undetermined) before she calves.

COD-LIVER OIL AND CARROTS AS SUPPLEMENTS TO POOR-QUALITY HAY

Nineteen cows have now calved on rations of grain and U. S. No. 3 timothy hay in which carrots were fed to supplement the vitamin A in this poor-quality hay. The cows were fed 20 pounds of carrots daily while in milk and only 5 pounds daily during the dry period. Of 19 calves born, 16 apparently were normal at birth, 2 were carried to full term but were born dead, and 1 was aborted.

There have now been 17 calvings by cows on the grain and U. S. No. 3 timothy-hay ration, in which 20 milliliters (4 teaspoonfuls) or more of cod-liver oil was fed daily to supplement the vitamin A in the hay. Thirteen of their calves were normal at birth; 3 were abortions (2 by the same cow); and 1 died during delivery. One cow that aborted her first calf after 6 months of pregnancy has now had 3 normal calves and is again pregnant on this feeding regime. She was reared on whole milk for about 1 month, and on skim milk and 20 milliliters of cod-liver oil thereafter up to 6 months of age. She has never received any feed but the grain and poor-quality hay used in these experiments, and the 20 milliliters daily of cod-liver oil has been continued throughout as her only vitamin A supplement. Her one abortion was not infectious but occurred earlier in pregnancy than

is usual with vitamin A-deficient cattle. Her subsequent performance would indicate that the cod-liver oil was adequate to supply the vitamin A for normal calving, even with the drain of lactation intervening.

Two heifers that were raised in the same way as this cow, except that they received 10 milliliters of cod-liver oil daily instead of 20 milliliters, reached calving age during the year and calved normally. These cows are being continued on this low vitamin A intake to see whether, after the drain of lactation upon their bodily reserves, they will still reproduce normally on this feeding regime. There is no evidence of ill effect on milk yield, as one of these heifers in the first 6 months of her lactation period produced 10,327 pounds of milk containing 328 pounds of butterfat.

DETERMINING THE CAROTENE CONTENT OF CATTLE FEEDS

Determination of the carotene content of cattle feeds necessarily continues in connection with other experiments. The results of several years of work on the carotene content of market hays and corn silage were published. The report included a study of methods of determining carotene content. This year aliquots of carotene extracts from all hays and silages were submitted to chromatographic analysis, as described in the above report, in order to get at more nearly their real carotene content. The pigmented impurity separated by adsorption filtration from carotene extracts prepared from hays by the Willstätter and Stoll procedure was tested and found to be practically inactive as a source of vitamin A.

The work on the chromatographic determination of carotene, which led to the development of this method in this laboratory, was started in the fall and winter. The results from a quantitative standpoint were very satisfactory; but when warm weather came in the spring, there was evidence that carotene was being destroyed during the adsorption filtration. To test the effect of temperature, three aliquots of a previously purified carotene extract were filtered at different temperatures and the filtrates read with a photoelectric colorimeter. The results were as follows: At room temperature 33° C., no carotene was recovered in the filtrate; when temperature was controlled at 18° to 20°, 81 percent of carotene was recovered; when temperature was controlled at 5°, 97 percent of the carotene was recovered.

The temperature is now controlled in all chromatographic filtrations of carotene in this laboratory.

Since March 1, 1937, two samples of the corn silage fed at this station have been taken daily, put together, and analyzed monthly for carotene. The average carotene content of 26 such monthly composite samples was 14.0 milligrams per kilogram as fed or 51.3 milligrams per kilogram of dry weight. These results were obtained with samples done by the modification of the Willstätter and Stoll procedure used in this laboratory. Where the pigmented impurity finally associated with the carotene in this procedure was removed by chromatographic analysis, the average carotene content of the silage as fed was 9.8 milligrams per kilogram or 36.7 milligrams per kilogram of dry weight. The corn for the making of silage here is cut in the early dough stage when the kernels are only slightly dented. Not all of these samples of silage were preserved in the same type of

silo. Most of them came from a concrete silo, and these were the highest in carotene content. A few samples from a snow-fence silo contained about 60 to 80 percent as much carotene as those from the concrete silo, and those from a straw silo only about 16 percent as much.

An experiment was started in the fall of 1937 to determine the relation between the carotene content of the silage and that of the plant from which it was made, as well as the effect of storage on the carotene content of the silage. This experiment is incomplete; but comparisons were made of six samples that were stored 1 year or less. Results may be summarized as follows: (1) When the samples were analyzed by a modification of the Willstätter and Stoll procedure, the average "carotene" content of the silage was 14 percent higher than that of the corn plant from which it was made; (2) when the samples were chromatographed to remove pigmented impurities other than carotene, the carotene content of the silage was 4 percent lower than that of the corn plant from which it was made; (3) when samples were analyzed by the Willstätter and Stoll procedure, the average amount of pigmented impurity was 250 percent more in the silage than in the corn from which it was made.

From the above data it is evident that there actually was no increase of carotene in the silage as compared with that in the corn from which it was made. It appears that the contrary results so often reported may be due to an error in the method of determining the carotene.

The pigmented impurity that was separated chromatographically from the carotene in extracts from hays was found by biological assay to possess an amount of vitamin A activity that was practically an insignificant part of the total activity of the hay; and this activity may have been due to very small traces of carotene.

MINERALS IN CATTLE FEEDING

Six pairs of heifers were used in the experiment (described in last year's report) on the effect on growth of adding bonemeal to rations low in calcium and adequate in both vitamins A and D. The basal rations consisted of a grain mixture, U. S. No. 1 timothy hay that was as low in calcium content as was obtainable on the market (0.25 to 0.30 percent) and 20 milliliters of cod-liver oil daily. The animals were started on the experiment at 6 months of age and fed for 1 year. The average gain in weight was 405.8 pounds on the basal ration and 405.7 pounds on the bonemeal ration—practically identical. Work is now in progress with animals receiving less calcium in their basal ration.

SIMPLE RATION FOR A BREEDING COLONY OF RABBITS

Since the starting of the rabbit colony in the nutrition laboratory, the feeding regime recommended by the Bureau of Biological Survey has been followed with the breeding stock. This year a new stock ration was tried. It consists of ground whole wheat, a very good grade of sun-cured alfalfa-leaf meal, soybean meal, calcium carbonate, and sodium chloride all pressed into pellets. Preliminary work indicates that this pelleted ration is very satisfactory for pur-

poses of lactation as measured by the rate of growth of standard-size litters, and for the later growth of young rabbits. Standards of comparison for lactation performance are being determined.

STUDY OF AMINO ACIDS AND PROTEINS

It is very important to investigate any chemical reaction that may prove sufficiently specific to be used in estimating an amino acid or group of amino acids in a protein. It was not known whether a certain reaction of periodic acid could be applied to amino alcohols, but workers in this Division foresaw its important application to the study of certain amino acids and proteins if this could be done.

The reaction, which is believed to be new, was found to be effective. Serine, for instance, is rapidly and completely oxidized at room temperature to give formaldehyde, glyoxylic acid, and ammonia. In this case it is possible to isolate 95 percent of the formaldehyde as a pure solid derivative. After further oxidation with bromine, it is possible to separate oxalic acid, but as yet not quantitatively.

It seems probable that a much more accurate and definite method for the determination of serine in amino acid mixtures can be developed on this basis. The same is probably true of the amino acid, threonine (for which rapid reaction has also been demonstrated), and for less well known or doubtful beta-hydroxy amino acids. A preliminary report of this work was published.

A moderately complete study of the action of metaperiodic on other amino acids indicates easy reaction for only a few (thus far, cystine, tryptophane, methionine) and suggests that interference of these in prospective analytical methods can probably be avoided.

DIVISION OF DAIRY RESEARCH LABORATORIES

L. A. ROGERS, *in charge*

CHEMISTRY AND BACTERIOLOGY OF MILK

Bacteria are important in the manufacture of nearly all dairy products. It is very desirable, therefore, to increase the fund of information available about the conditions that control the growth and activity of bacteria and especially about the effect they have on each other when growing in mixed cultures. An extensive study was made of some of the conditions promoting or inhibiting the growth of bacteria, using for this purpose some of the cultures employed in making dairy products.

The mutual inhibiting effect of different types of lactic bacteria was determined and an explanation found for at least a part of these effects. It soon became evident, however, that it would be necessary, before this line of investigation could be continued, to establish more definitely the various chemical and physical factors that influence the rate of growth and particularly the limits of growth. It was found that even within the limits of a genus there is a quite wide variation in the relation of reaction of the medium to growth of the culture and especially to the amount of inoculation required to initiate growth.

An incidental result of this work was the development of a simple and comparatively inexpensive medium for growing the eye-forming

culture used in Swiss-cheese making. There are also among the propionic bacteria marked differences in tolerance to sodium chloride, which are of interest in the manufacture of Swiss cheese.

In the course of investigations on the sporicidal action of ultraviolet rays, a byproduct of irradiation (hydrogen peroxide) was found to possess marked bacteriostatic activity. Bacterial spores that withstand prolonged exposure to high temperatures were destroyed in a comparatively short time by hydrogen peroxide, when it was applied in the proper concentration and in combination with a favorable temperature and hydrogen-ion concentration. Under these conditions, milk heavily inoculated with heat-resistant bacterial spores may be completely sterilized. The peroxide may be removed with the enzyme catalase, which is now available in a crystalline form. The results obtained indicate that there is a time factor which makes it unlikely that anything approaching instantaneous sterilization will be attained. Milk sterilized in this way acquired a peculiar flavor on standing. Unless this difficulty can be overcome, it will prevent the commercial application of this method of sterilization, but the method may be useful in sterilizing bacteriological culture media when the use of heat would produce undesirable changes.

Before attempting to investigate the nutritive value of milk fat, with the grant from Bankhead-Jones funds, it is necessary to obtain more detailed information about the composition of this complex combination of glycerides. This is especially true of some of the minor constituents, whose composition, and even identity, is still a matter of doubt. The work so far has been almost entirely on methods of separating the fatty acids. A satisfactory method was developed for separating the hydroxy from the nonhydroxy acids.

Since oxidation plays an important part in the deterioration of various dairy products, especially those in which the fat is exposed to the oxygen of the air, study of the conditions that affect the rate and extent of oxidation of fats was continued. A study was made of the catalytic effect of the different bands of the visible spectrum upon the autoxidation of a variety of fats and oils, by using an apparatus permitting the adjustment of the intensity of the light to a uniform value for each band.

The work on the oxidized flavor of milk was completed, and the results are being prepared for publication.

ICE-CREAM INVESTIGATIONS

The results of several years' investigation of the factors that influence overrun were published. The effect of a great variety of factors on overrun was shown in mathematical terms. It is noteworthy that 100-percent overrun, the highest usually considered desirable, can be obtained with practically all mixtures. It is a matter of so adjusting the freezing process that the required temperature is reached in the freezer, within the necessary time interval, before churning starts. The realization of this fact should do much to clarify the confusion that exists concerning the comparative whipping properties of various mixes and the procedure that must be followed to obtain higher overruns. Other things being equal, those ice-cream mixes that can be drawn from the freezer with the greatest amount of water in the form of ice make the best-textured ice cream, because the ice crystals

will not grow so much in the hardening room; therefore, such mixes are to be preferred.

A few years ago a method was developed by which the milk solids not fat in an ice-cream mix may be increased without danger of the objectionable sandy texture in the ice cream, which is caused by crystallization of the lactose. In this process, sucrose is added to skim milk in the proper proportion, and the mixture is concentrated under a vacuum to a point at which crystallization of the lactose takes place on cooling. Since the sucrose prevents excessive thickening, the lactose crystals may be removed by centrifuging in the usual way to make a self-preserving skim-milk product that is low in lactose. Since this product permits the manufacture of an ice cream with a better texture and a higher nutritive value, and at the same time provides an outlet for a large quantity of surplus milk constituents, its general adoption is greatly to be desired. The method was used by one ice-cream manufacturer this year with very satisfactory results.

UTILIZATION OF DAIRY BYPRODUCTS

INDUSTRIAL USES

Within the last few years reports have reached this country of a European development of a textile fiber from casein. No patent has been issued in this country on this European process, and it is only very recently that information concerning it has become available through the publication of foreign patents. In the meantime, this Division developed a process by which a fiber having many of the characteristics of wool may be made from any acid casein of good quality, and public-service patents have been obtained. Casein fiber is not as strong as wool, but it has the same resiliency and takes the same dyes. However, it is not likely that it will, in the near future at least, become a competitor of wool. Rather it should be looked upon as a means of extending the use of fabrics containing wool. By mixing casein fiber and wool it is possible to make fabrics having the desirable properties of wool but at a lower price.

The method has been tested on a semiplant scale and is considered sufficiently advanced to warrant its use commercially. Since the manufacture of this fiber will require the same equipment and technical experience as rayon, it is not adapted to the ordinary dairy establishment. It is probable that its commercial development will be through already-established rayon companies, although the formation of special organizations has been actively discussed in dairy regions and it is reported that a plant will be built at once for the manufacture of a casein fiber by a process developed privately and presumably differing from the European and that devised by this Division.

If casein fiber comes into commercial use, as there is every reason to think it will, the market for casein will be materially extended and stabilized, but milk producers should not look to it as a means of producing any marked increase in the price of fluid milk. Casein is only one of the numerous constituents of milk, and the returns from milk necessarily depend on an ability to market all of its compotent parts efficiently.

If this development merely reduces the wide fluctuations in the casein market, it will serve a very useful purpose. When the demand comes for casein for fiber the industry should be prepared to furnish casein of a uniformly high quality.

Work is being continued on derivatives and compounds of casein with the object of improving the strength of the casein fiber, and an investigation has been started to develop a means of simplifying the process of making a good grade of casein so that it will become more nearly automatic and labor costs will be reduced.

In 1928, this Division published the results of the first of a series of investigations showing that the lactose of whey could be converted into lactic acid in a short time. On the basis of this information the commercial manufacture of lactic acid from whey was successfully established. While manufacturers have had no difficulty in selling all the acid produced, the somewhat limited market for lactic acid has retarded the growth of this industry.

A considerable quantity of lactic acid is now used in making plastics, but since little acid of sufficient purity for this purpose is made in this country most of it is imported. In attempting to extend the outlet for lactic acid, this Division recognized the need for a better method of purifying, under commercial conditions, the crude acid produced in this country. Such a method was developed and tested on a pilot-plant scale in a commercial plant with such success that the plant is now taking steps to put it in operation. The capacity of the plant will be materially increased, and it will then be in a position to produce an acid of sufficient purity for any use to which lactic acid may be put.

This Division has also made a large number of esters and other combinations of lactic acid, some of which may find applications in industry. The most notable success has been in the preparation from lactic acid of a polymethylacrylate, a water-clear resin with remarkable elasticity and other properties which make it valuable for impregnating cloth, dressing leather, insulation, and probably many other uses which cannot be foreseen. This resin is now made by a synthetic process, but at a cost which limits its use. The lower cost of making it from lactic acid should encourage its wider use in various industries and thus greatly extend the market for lactic acid.

In addition to the methyl acrylate, a number of resins have been made from lactic acid that have properties which are essential for coating cans and for similar purposes, but certain defects which limit their commercial use have not yet been eliminated.

At the present stage of development, the manufacture of lactic acid by fermentation of whey is a large-scale operation, and plants that have less than 100,000 pounds of whey daily are not advised to undertake its manufacture. However, as the industry develops, it seems that any plant with sufficient volume of whey to justify the installation of a vacuum pan could make crude calcium lactate and depend on central plants to convert the crude lactate to lactic acid or a derivative.

FOOD USES

Last year this Division reported a new method of separating the constituents of whey, based on the removal of the lactose from concentrated whey by alcohol. Enough work was done on a pilot-plant

scale this year to indicate that the method will work on a commercial basis and that substantially all of the alcohol may be recovered. The mixture of alcohol and concentrated whey is forced through a filter press which removes nearly all the soluble proteins, some sugar, and part of the salts. The concentrated whey is then freed from alcohol in a vacuum drier, and a white water-soluble powder is obtained, containing about 40 percent of protein, largely in the form of lactalbumin. After the reaction of the filtrate is adjusted and a short time has been allowed for crystallization, the lactose is removed by centrifuging and is sufficiently pure to meet the requirements of the pharmaceutical grade. The alcohol in the filtrate from the centrifuge is recovered by distillation, leaving a residue which contains in a concentrated form most of the water-soluble vitamins that were in the original milk.

The possibility of using the soluble powder containing the albumen in some food product is now being investigated. The vitamin residue can undoubtedly be sold as an ingredient of poultry feed, but some new use must be found for the lactose. Laboratory-scale experiments have shown that under certain combinations of temperature and chemical reaction a concentrated solution of this lactose is converted into a sirup containing a mixture of dextrose, galactose, and lactose. Experiments on a larger scale will be necessary to determine whether this is commercially feasible and whether there is a market for a sirup of this type.

The experimental work on the use of whey solids in confectionery was completed, and the data were prepared for publication. This work has shown that whey solids may be utilized advantageously in the commercial manufacture of fudge, taffy, and caramels, at the rate of 20 to 30 percent of the total solids. A new type of candy was devised, containing 40 percent of whey solids, with cereal to mask the whey flavor. The use of whey solids not only reduces the excessive sweetness of these candies and increases their nutritive value, but, by displacing some of the more expensive ingredients tends to lower the cost of the candy. Whey solids may be used in the dry form, but a sirupy product may be made by adding sucrose to the whey and condensing it under vacuum to provide a satisfactory form for shipping and storing.

The value of whey solids in soups has been demonstrated, and soup preparations of vegetables and whey solids are now made commercially. A dried-pea soup was made in which the defects of the ordinary dried soup are largely eliminated. The ordinary dried soups lose their property of hydration and, when reconstituted, appear thin and watery; adding thickening agents tends to mask the characteristic flavor of the soup. In the dried-pea soup made with whey solids the hydrating property is retained, and a soup of any desired consistency may be obtained by adding water and heating. This dried soup is also unusual in that, although the normal amount of fat is included, it does not become rancid on storage.

Some progress was made in developing uses for whey solids in bakery goods, a field which offers a potential outlet for a large volume of dairy products. A very satisfactory canned pudding was made from inexpensive ingredients, including whey solids in place of eggs, but further work is necessary to overcome a slow change in

texture, the results of which are somewhat similar to the change which takes place in the staling of bakery goods.

The use of dairy byproducts in foods is not necessarily limited to their substitution for ingredients of established foods. There is also the possibility of combining milk or some combination of its constituents with other products to make new forms of foods, confections, or beverages. A start in this direction was made by combining skim milk with potatoes to make a new product having some of the characteristics of potato chips but an added advantage in that since it contains no fat it has excellent keeping qualities and can be made in regions remote from the markets, where skim milk and cull potatoes are cheap. This combination can be made up in almost any form so that it may be served as a breakfast cereal or in sticks or wafers with soup, salads, or tea.

CHEDDAR-CHEESE INVESTIGATIONS

The general low grade of the great bulk of the Cheddar cheese made in this country, even in the older cheese sections, is a matter of common knowledge. Investigations by this Division, including both laboratory work and field observations, indicate that the correction of this condition lies easily within the power of the manufacturer and the milk producer. While cheese is a complicated product, both biologically and chemically, and many factors combine to determine its quality, three factors are of major importance in establishing the texture and flavor of the ripened cheese.

The first factor is the bacteriological condition of the milk from which the cheese is made. While it is easily possible to make poor cheese from good milk, it is very difficult if not impossible to consistently make good cheese from milk coming to the factory with a high bacterial count. Pasteurization is a partial remedy and is of value in helping to produce a uniform product; but even when the milk is pasteurized, it is necessary to eliminate the bacteriologically poor milk. Tests so simple that any cheese maker can use them are now available which indicate the bacteriological condition of the milk with reasonable accuracy.

The second factor is the control of the manufacturing process with particular reference to the acidity developed at each step. While the better cheese makers watch the acid formation with great care and control it according to generally accepted standards, the experimental results in this Division, which are fully corroborated by field observations, show that the acidity limits essential to a good flavor are very narrow and do not agree with those commonly adopted in the factories.

The third factor is the adaptation of the curing-room temperature to the particular characteristics of the cheese to be ripened. It is clear that the present practice of storing cheese at 34° F. (from a few days after it is made to the time of distribution) is sound when applied to the high-acid, high-moisture cheese now generally made. This low temperature retards the development of the sharp and bitter flavors which invariably appear in cheese of this type if it is held at higher temperatures. On the other hand, data which we have obtained and which are now ready for publication, will show that cheese made from good milk with proper control of the acid

development should be cured at a much higher temperature to develop the characteristic flavor of Cheddar cheese.

None of these changes from established methods would involve any appreciable additional expense or labor or any increased skill but, if put into effect, could not fail to increase the consumption of cheese by furnishing the consumer with a mild and pleasantly flavored product. It is obvious, however, that present practices are so firmly established and so generally accepted as sound that new methods will be adopted only after convincing field demonstrations. This is now being attempted in a small way, in cooperation with the University of Wisconsin, by one fieldman using the trailer laboratory. To make any impression on the industry as a whole within a reasonable time, this phase of the work would have to be materially extended.

SWISS-CHEESE INVESTIGATIONS

In the application of the pure-culture method to Swiss-cheese making, it was frequently observed that although the cultures were used in the proper proportion and at the right stage of development the expected effect in the cheese was not obtained. A careful study of the cultures, which have been in use many years, showed that in repeated and long-continued propagation under laboratory conditions they had lost in some measure the ability to function properly at the high temperature which they encounter in the cheese kettle and press. This condition has been corrected by growing the cultures every day under conditions that provide automatically a temperature range corresponding to that which occurs in a cheese. It is evident, however, that some factor associated with the composition of the medium in which the cultures are grown has a direct relation to the action of the culture in the cheese. Since this effect is not evident in any change in the culture itself but can only be demonstrated by the effect on the ripened cheese, progress in determining this factor is very slow. However, enough evidence has been accumulated to show the possibility of greatly increasing the efficiency of the cultures.

An investigation of the relation of the fat and moisture content of Swiss cheese to the quality of the cheese was completed, and the data are ready for publication. The laboratory results obtained under experimental conditions were confirmed by data collected by the fieldmen working in the commercial factories in Wisconsin and Ohio. These data show that there are definite limits for both water and fat beyond which the cheese maker cannot go without injuring the quality of the cheese. Apparently a careful cheese maker has no difficulty in keeping within these limits if he so desires.

NEW METHOD OF MERCHANDISING SWISS AND CHEDDAR CHEESE

A large part of the Swiss cheese is sold over lunch counters and in cafes in the form of slices in sandwiches. The large loaf in which Swiss cheese is made is not only unsuited to this type of marketing but is almost unknown outside of the producing section and the larger cities. In any system of getting the large loaf into sandwich form there is inevitably a great waste, which in an ordinary cheese will approximate 30 to 35 percent of its weight. If the cheese is

cut at a central point the actual waste may be greatly reduced by using all parts not suitable for slicing for making process cheese.

A successful commercial demonstration was made of the practicability of packing sliced Swiss cheese in cans for distribution to lunchrooms and restaurants. Selected cheese is cut into blocks that have a cross section approximating that of a loaf of bread. These blocks are cut by machine into uniform slices, which are then made into one or more packages, wrapped in cellophane, and packed in cans holding about 4½ pounds. If the cheese is of good quality and the storage temperature is not too high, this package may be held indefinitely. The lunch-counter proprietor buying cheese in this form has no waste, the cheese is ready to serve, and he knows exactly how many sandwiches may be made from each package. The convenience and economy of this package is so obvious that there has been no difficulty in interesting managers of all classes of lunchrooms and restaurants in it, and a business is already established for distributing Ohio Swiss cheese sliced and in cans.

There is an even greater opportunity for marketing Cheddar cheese in this form. The volume of Cheddar cheese used in sandwiches is much greater than that of Swiss cheese, and it is very evident that the lunch-counter proprietor would be glad to pay the extra cost of slicing and canning for the convenience of the package. Cheddar cheese has the advantage of being susceptible to ripening in the can. The curd may be pressed into loaves of the proper cross-section size and shape, sliced, and sealed in cans as it comes from the press. The cheese ripens in the can and is ready for sale to the sandwich maker, without removal from the can.

The use of cans for a retail cheese package has been retarded by a general belief that the can would add too much to the cost of the package. The can used most extensively at present holds ten ½-pound prints and adds much less to the cost per pound of cheese than the can holding 1 pound or less. A type of can is now available, in sizes holding any number of prints desired, that can be hermetically sealed without the use of a sealing machine. If a can holding 20 pounds in the form of ½-pound prints is used, the can itself will add to the cost of the cheese only slightly more than the container for a single 20-pound daisy, and the additional cost will be overcome by the saving on shrinkage, labor of handling, and other items. This type of can is suitable for opening by the retailer, who then has a number of attractive prints available for dispensing, each of which is already cut, weighed, and wrapped for the purchaser. Half-pound prints wrapped in heat-sealing cellophane may be held under proper refrigeration for at least 2 or 3 weeks without molding or perceptible drying.

FOREIGN-TYPE CHEESE

A few years ago assistance was given in the establishment of a small factory in a city milk area making a cheese of the Bel Paese type by methods worked out in this laboratory. This factory was handicapped by the fact that most cheese consumers were unfamiliar with this cheese and that it was obliged to compete with imported cheese for the small business that was available. Notwithstanding these obstacles, the business is now on a profitable basis and is another demonstration that it is possible to establish the manufacture of the foreign-type cheeses in this country.

DIVISION OF MARKET-MILK INVESTIGATIONS

ERNEST KELLY, *in charge*

DAIRY-SANITATION INVESTIGATIONS

The mastitis investigations started in 1937 were continued, but the majority of the cows under study have not yet completed enough lactation periods to justify a detailed analysis of the data. During the year 1,139 individual quarter samples of milk from 28 cows were examined for evidence of mastitis. Of these, 208 samples from 8 cows showed streptococcic infections; 87 samples from 14 cows yielded *Pseudomonas aeruginosa;* and 28 samples from 3 cows yielded other organisms that apparently were causing mild infections. Seven cows showed no infection in any of their samples.

A new method was developed for using the Hotis test for *Streptococcus agalactiae* in milk, which improves its usefulness without involving much additional work. The test is set up with bromo-cresol purple in the usual manner. This shows immediately whether the sample is normal or alkaline in reaction. The tubes are then incubated at 37° C. for 20 to 24 hours and examined for the characteristic canary-yellow flakes, which may occur with or without the development of acid in the milk. A distinctly positive test is then discarded as completed. Under the new procedure all "suspicious" or negative samples are then examined microscopically for the presence of long-chain streptococci. Quantitative experiments show that the concentration of dye in the Hotis test is not so great that it will delay or retard the growth of mastitis streptococci.

Experiments were started to compare five different tests used in determining the quality of milk and to evaluate the tests in terms of the keeping quality of milk. Keeping quality is determined by dividing the sample of milk into several half-pint milk bottles, storing in a refrigerator held at 10° C., and removing a bottle at certain intervals for determination of the flavor score. A score of 15 is considered the end point. Twenty samples of raw milk were tested, but the data are too few to permit any conclusions to be drawn as yet. Furthermore, the samples tested have generally been of excellent quality, with none that would be considered poor milk. Only one sample had a plate count at 37° greater than 30,000 per milliliter, and no sample had a standard methylene blue reduction time of less than 7½ hours. The experiments will be continued until a statistically significant number of samples covering a wide range of quality has been studied.

The work on chlorine disinfectants was completed, and the results were prepared for publication. Similar work on corrosion of various metals was conducted with sodium hydroxide solutions, under conditions simulating treatment of milking machines by alkalies. Dilute alkali solutions of 0.3, 0.5, and 0.7 percent of sodium hydroxide corroded various metals to different degrees. The aluminum alloys were practically destroyed. Tin was corroded to some extent. Nickel showed no corrosion for the 0.3- and 0.5-percent strengths and only a very small amount for the 0.7-percent solution. The other metals showed only slight corrosion.

Studies were made of the phosphatase test, which is used to determine whether milk has been properly pasteurized, with a view to im-

proving the test. The work done included preparation of a phosphatase enzyme solution from the cow's udder. The initial rates of hydrolysis of disodium phenyl phosphate by the phosphatase were determined at various substrate concentrations and various pH values. This work is expected to be completed during the coming fiscal year.

MILK-PLANT-MANAGEMENT STUDIES

A study of the data obtained on milk-plant equipment from questionnaires returned by milk dealers, brought out the following facts:

The useful life of milk-plant equipment of various kinds is longer than formerly, principally because of improvements both in design and in materials used.

Bottle washers of the soaker type are used more extensively than formerly. The use of this type of washer with a conveyor system to the fillers greatly reduces the labor required for washing and filling the bottles. Vacuum fillers are now used in many large plants.

Practically all plants using the continuous system of pasteurization have facilities for storing the raw milk and, as a rule, the total raw-milk storage capacity is over 75 percent of the total quantity of milk handled. Less than one-fourth of the plants using the batch system of pasteurization have raw-milk storage tanks, and their total raw-milk storage capacity is less than 25 percent of the total milk handled. Most of the smaller plants using the batch system of pasteurization have no raw-milk storage tanks.

Practically all plants using clarifiers clarify the milk at a low temperature, while formerly about half of them preheated the milk before clarifying it. Filters are still more commonly used than clarifiers, but more milk is now filtered cold. Clarifiers have been developed in recent years which clarify the milk efficiently at low temperatures without causing foam. Clarifying milk cold has practically no effect on the creaming ability of milk, but clarifying at higher temperatures may injure the cream layer.

The average temperature of pasteurization at plants using the holding system is approximately 143.5° F., and the most common temperature is 143°. At the plants using the high-temperature, short-time system of pasteurization, the average temperature is 161.3°, varying from 156° to 162°. Much less floor space is required for the equipment for the latter system of pasteurization and there is much less equipment to be cleaned. However, its use is not permitted by the health officials in some States.

The number of plants using the batch system of pasteurization is less than formerly and the number using the continuous-flow system is greater. The types of heaters now commonly used are internal tubular, surface tubular, plate-heat exchangers, and electric pasteurizers. The use of tanks, spray vats, and rotating type of pocket holders, is more common than formerly, whereas coil vats, stationary pocket holders, and long-flow tubular holders are not so commonly used. Fewer internal tubular coolers are used, and more heat exchangers and surface tubular coolers, especially of the fan or cabinet type, are used.

The use of direct-expansion ammonia and also sweet water for cooling milk is increasing, and the use of brine and ice water is

decreasing. The use of brine is somewhat less efficient and more expensive than direct expansion for most plants.

Pasteurization in the bottle is no longer practiced; no doubt because of the fact that this system has been found to be more expensive and also unsatisfactory from the standpoint of efficient pasteurization.

The use of stainless steel in milk-plant equipment is now quite common, especially for raw-milk storage tanks, pasteurizing equipment, and bottle fillers. Most plants, both large and small, now use mechanical refrigeration. The capacity of the machines is approximately 1 ton per 100 gallons of milk handled, though it is greater than this at small plants. Coal is still the fuel most generally used in steam boilers, but the use of oil and gas is increasing.

Large quantities of ice are required on the milk-delivery routes, the average being approximately 200 pounds for each 100 gallons of milk handled. Much of this ice is manufactured in the milk plants, the average ranging from 11.8 percent at the smallest plants to 79.2 at the largest. Unit coolers are used extensively in the milk-storage rooms. Where this system is used, the air in the room is much drier.

Fewer men are required to operate milk plants than formerly, because of more efficient equipment and the higher speed of some of the machines used.

MILK-QUALITY-IMPROVEMENT INVESTIGATIONS

CURD TENSION OF MILK

Work was continued to determine the effect of some factors on the curd tension of milk and the relation of curd tension to digestibility.

A method for determining curd tension by the use of hydrochloric acid and pepsin as the coagulant was outlined in last year's report. In order to set a standard for dividing milk into hard-curd and soft-curd milk, when determinations are to be made with the hydrochloric acid and pepsin solution as a coagulant, curd-tension measurements were made on 300 samples of milk by the Hill method and also by using the above coagulant. The average curd tension of the 300 samples was 43.6 grams by the Hill method and 30.45 grams by the hydrochloric acid-pepsin method. The latter gave readings approximately 30 percent lower than the Hill method.

Milk showing a curd-tension reading of 33 grams or less by the Hill method is considered as soft-curd milk. On this basis the 300 samples consisted of 180 samples of hard-curd milk and 120 samples of soft-curd milk. The hard-curd samples had an average curd-tension reading of 58 grams by the Hill method and of 41.4 grams by the hydrochloric acid-pepsin method. The reading was approximately 29 percent lower by the latter method. The soft-curd samples had an average curd-tension reading of 21.6 grams by the Hill method and of 14.2 grams by the hydrochloric acid-pepsin method, or approximately 34 percent lower by the latter.

The above data indicate that if a curd-tension reading of 33 grams is the proper dividing line between hard-curd and soft-curd milk by the Hill method, a lower reading should be used with the hydrochloric acid-pepsin method. Approximately 21 grams appears to be a reasonable dividing line for the latter method, but more data on the relation between curd tension and digestion are necessary before a definite standard can be set.

EFFECT OF HOMOGENIZING PRESSURE ON CURD TENSION OF MILK

Homogenization lowers the curd tension of milk. The degree to which it is lowered depends primarily on the pressure of homogenization and, to some extent, on the curd tension prior to homogenizing. Table 3 shows the effect of homogenization on the curd tension of pasteurized milk with an average fat content of 4.0 percent.

TABLE 3.—*Effect of homogenization on the curd tension of milk*

Homogenizing pressure (pounds)	Average curd tension		Homogenizing pressure (pounds)	Average curd tension	
	Hill coagulant	Hydrochloric acid-pepsin coagulant		Hill coagulant	Hydrochloric acid-pepsin coagulant
	Grams	*Grams*		*Grams*	*Grams*
0	49.2	35.9	2,000	23.9	13.6
500	43.9	29.6	2,500	22.0	13.6
1,000	33.2	19.5	3,000	21.3	13.1
1,500	28.0	16.0			

These data indicate that, from a curd-tension standpoint, the maximum pressure of homogenization need not be greater than 2,500 pounds. Only a slightly greater reduction in curd tension is obtained at higher pressures.

CURD TENSION OF A MIXTURE OF HOMOGENIZED AND UNHOMOGENIZED MILK

A study was made of the effect on curd tension when homogenized milk is mixed with unhomogenized milk in varying amounts. The unhomogenized milk used in this study had an average curd-tension reading of 63.9 grams by the Hill method and 48.0 grams by the hydrochloric acid-pepsin method. The homogenized milk had an average curd-tension reading of 17.3 grams by the Hill method and 11.6 grams by the hydrochloric acid-pepsin method.

When the mixture consisted of 25 percent of homogenized and 75 percent of unhomogenized milk, the average curd tension of the mixture by the Hill method was 44 grams, or approximately 31 percent lower than that of the unhomogenized milk. By the hydrochloric acid-pepsin method, the average curd tension was 31.2 grams, or approximately 35 percent lower than that of the unhomogenized milk.

When the homogenized and unhomogenized milks were mixed on a 50-50 basis, the average curd tension of the mixture by the Hill method was 33.2 grams, or approximately 48 percent lower than that of the unhomogenized milk. With the hydrochloric acid-pepsin method the average curd tension of the mixture was 22.3 grams, or approximately 53.5 percent lower than that of the unhomogenized milk.

A mixture of 75 percent of homogenized and 25 percent of unhomogenized milk gave a milk with an average curd tension of 22.7 grams by the Hill method, which was approximately 64.5 percent lower than that of the unhomogenized milk. With the hydrochloric acid-pepsin method, the average curd tension of the mixture

was 16.4 grams, or approximately 66.5 percent lower than that of the unhomogenized milk.

EFFECT OF PARTIAL FREEZING ON THE CURD TENSION OF MILK

In cold climates milk frequently becomes partly frozen. To determine the effect of partial freezing on the curd tension of milk, bottled milk was held for 4 hours at 0° F., then slowly thawed at room temperature, and compared with duplicate samples that had been held at 45°. Curd tension was measured by the hydrochloric acid-pepsin method. The pasteurized milk that had been partly frozen had an average curd tension of 63.3 grams as compared with 63.8 grams for the unfrozen samples. Homogenized milk had an average curd tension of 22 grams for both the frozen and unfrozen samples. The curd tension of milk is not affected by partial freezing.

RELATION OF CURD TENSION TO DIGESTION

Results were reported last year showing that soft-curd milk (boiled) digests more rapidly but not more completely than hard-curd milk (raw). This year, to determine whether lowering the curd tension by homogenization has the same effect on digestibility as boiling, comparisons were made with homogenized and unhomogenized milk. The curd tension was measured with hydrochloric acid and pepsin as the coagulant.

Effect of homogenizing at 1,000 pounds pressure.—Raw milk having an average curd tension of 58 grams was homogenized at 1,000 pounds pressure and pasteurized. The homogenized-pasteurized milk had an average curd tension of 29 grams. Digestion determinations showed that the homogenized milk was digested somewhat more rapidly than the raw milk. The homogenized milk showed an average of 27.2 and 26.8 percent more digestion at the end of 15 and 30 minutes, respectively, than the raw milk. Thereafter, the difference in the amount of digestion decreased, the difference in favor of the homogenized milk being 7.8, 3.8, 3.1, 0.8, 0.8, and 0.0 percent at the 45-minute, 1-, 2-, 3-, 4-, and 5-hour intervals, respectively.

Effect of homogenizing at 2,500 pounds pressure.—The digestibility of raw milk having an average curd tension of 50.2 grams was compared with that of similar milk the curd tension of which had been reduced to an average of 16.7 grams by homogenizing at 2,500 pounds pressure and pasteurizing. The relative rate of digestion for these milks was similar to that shown by raw and boiled milks. The boiled milk, however, showed a higher rate of digestion during the first 15 minutes than the homogenized milk. On the other hand, the rate of digestion did not decline as rapidly for the homogenized milk as it did for the boiled milk. The homogenized milk showed an average of 56.5, 40.5, 30.1, 22.2, 15.4, 9.3, 4.9, and 0.77 percent more digestion than the raw milk at the 15-, 30-, and 45-minute, and 1-, 2-, 3-, 4-, and 5-hour intervals, respectively.

Effect of pasteurization.—Inasmuch as the homogenized milk was also pasteurized, studies were made to compare the digestibility of raw and pasteurized milks. Milk with an average curd tension of 54.2 grams was compared with similar milk having an average curd tension of 52.1 grams after pasteurization. Although the pasteurized

milk showed a very slight increase in the rate of digestion as compared with raw milk, the results indicate that there is no material difference in the digestibility of raw and pasteurized milks. The average differences in the rate of digestion were 0.9, 0.8, 0.6, 0.4, 0.2, 0.0, 0.08, and 0.03 percent at the 15-, 30-, and 45-minute, and 1-, 2-, 3-, 4-, and 5-hour intervals, respectively. The similarity in the rate of digestion of raw and pasteurized milk indicates that the increased rate of digestion shown by the pasteurized-homogenized milk over raw milk was due mainly to homogenization and not to pasteurization.

Curd size.—Work has been started to determine the relation of curd size to curd tension and digestibility. Rubber bags serve as artificial stomachs in which milk is digested for a period of 1 hour, after which the area of the curds formed is determined. While this work has not progressed sufficiently to warrant definite conclusions, it has shown that the curds formed with soft-curd milk are smaller and therefore have a greater exposed surface than the curds formed with hard-curd milk. When the average curd tension of raw milk (46 grams) was reduced to 10 grams by homogenizing and pasteurizing, the average curd surface increased approximately 230 percent.

EDITORIAL AND INFORMATION WORK

L. S. Richardson, *in charge*

During the year 15 publications were printed in the Department series, 12 of which were new and 4 were revisions of existing publications. At the end of the year 10 manuscripts were being prepared for publication. Twenty-four publications were reprinted one or more times and 10 manuscripts prepared in other bureaus were reviewed. Fifty-nine articles written by members of the Bureau were edited for publication in dairy and agricultural journals outside the Department, and 17 publications were issued in mimeograph form for use in carrying on the Bureau's educational and service activities. Assistance was given the Radio Service in the preparation of 17 broadcasts, and 21 news releases were issued through the Department's Press Service. The Bureau also cooperated with the Extension Service in the preparation and revision of a number of film strips on dairy subjects, and with the Office of Exhibits in the preparation of dairy exhibits for State and interstate fairs.

PUBLICATIONS

The following articles and Department publications written by workers in the Bureau were issued during the fiscal year:

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The Hohenheim system in the management of permanent pastures for dairy cattle. T. E. Woodward, J. B. Shepherd, and M. A. Hein. U. S. Dept. Agr. Tech. Bul. 660. (With Bur. Plant Indus.)

Methods of evaluating pastures for dairy cattle. T. E. Woodward. U. S. Bur. Dairy Indus. BDIM–834. [Mimeographed.]

The chemical composition and nutrient yield of pasture grass grazed at successive intervals during the season. R. E. Hodgson and J. C. Knott. Jour. Dairy Sci. 22: 452–453. (With Wash. Agr. Expt. Sta.)

Relative values for milk production of hay and silage made from immature pasture herbage. R. R. Graves, J. R. Dawson, and D. V. Kopland. U. S. Dept. Agr. Tech. Bul. 649.

Making and feeding grass and other silages. T. E. Woodward, Assoc. South. Agr. Workers Proc. 1939: 89.

The digestibility and feeding value of apple and apple-alfalfa silage. J. C. Knott, H. K. Murer, R. E. Hodgson, and E. L. Overholser. Wash. Agr. Expt. Sta. Bul. 362. (In cooperation.)

The composition and apparent digestibility of pea silage, sun cured pea vines and artificially dried pea vines. R. E. Hodgson and J. C. Knott. Wash. Agr. Expt. Sta. Bul. 364. (In cooperation.)

Grass and legume silage. T. E. Woodward. Md. Crop Impr. Assoc. Rpt. Ann. Mtg. 1939: 5–11.

The carotene content of market hays and corn silage. H. G. Wiseman, E. A. Kane, L. A. Shinn, and C. A. Cary. Jour. Agr. Res. 57: 635–669.

Sorghum and soybeans for silage. E. W. Fairies. S. C. Agr. Expt. Sta. Ann. Rpt. 1938: 167–169. (In cooperation.)

The nutritive value of home grown roughage rations for dairy cattle. R. E. Hodgson, J. C. Knott, V. L. Miller, and H. K. Murer. Wash. Agr. Expt. Sta. Bul. 366. (In cooperation.)

Home grown roughages for dairy cattle. R. E. Hodgson, J. C. Knott, and O. J. Hill. Wash. State Col. Ext. Bul. 250. (In cooperation.)

The nutritive value of an alfalfa hay ration compared with a mixed grass and legume hay and grass silage ration for dairy cattle. Abstract. R. E. Hodgson, and J. C. Knott. Jour. Dairy Sci. 22: 448–449. (With Wash. Agr. Expt. Sta.)

A comparison of nutrient requirements with nutrient consumption by cows on all roughage rations. R. E. Hodgson, and J. C. Knott. West. Div. Amer. Dairy Sci. Assoc. Proc. Ann. Mtg. 1938: 39–43. [Mimeographed.] (With Wash. Agr. Expt. Sta.)

The dry matter consumption of Holstein cows on roughage rations. J. C. Knott, and R. E. Hodgson. West. Div. Amer. Dairy Sci. Assoc. Proc. Ann. Mtg. 1938: 35–38. [Mimeographed.] (With Wash. Agr. Expt Sta.)

The relation of color and carotene content of roughage in the dairy ration to the color, carotene content, and vitamin A activity of butterfat. R. E. Hodgson, J. C. Knott, H. K. Murer, and R. R. Graves. Jour. Agr. Res. 57: 513–528. (With Wash. Agr. Expt. Sta.)

BREEDING

Experiments in breeding Holstein-Friesian cattle for milk- and butterfat-producing ability, and an analysis of the foundation cows and of the first outbred generation. M. H. Fohrman, and R. R. Graves. U. S. Dept. Agr. Tech. Bul. 677.

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REPORT OF THE CHIEF OF THE BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE,
Washington, D. C., September 13, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith a report of the work of the Bureau of Entomology and Plant Quarantine for the fiscal year ended June 30, 1939.

Sincerely yours,

LEE A. STRONG, *Chief.*

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INTRODUCTION

The organization of the Bureau activities remains practically unchanged. The eradication and control of plant pests have been continued under a program expanded by allocations of emergency relief funds. There has been a curtailment in these operations as a result of reduced allotments.

As the result of extensive experiments to determine the possibility of so treating fruit originating in countries in which fruitflies are known to occur as to insure that it be free from infestation, fruit from certain fruitfly-infested areas has been admitted subject to sterilization by the time-temperature method. This method of treatment during the year was extended to cover the shipment of certain fruits and vegetables from Hawaii to the mainland.

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For the last 2 or 3 years the infestation of the pink bollworm in the lower Rio Grande Valley of Texas and across the international boundary in Mexico has been the cause of considerable concern because of the danger of spread into and through the main Cotton Belt. The efforts to suppress this infestation have attracted considerable attention, the most recent manifestation of which is Federal legislation approved August 9, 1939, authorizing conversations between representatives of the United States and Mexico to consider eradicating or controlling the pink bollworm in both countries by a cooperative program.

PUBLICATIONS AND EDITORIAL WORK

During the year 503 manuscripts were presented for publication and 488 were approved, 98 being submitted to the Department for publication and the remaining 390 to outside journals. There remained on hand 168 manuscripts, 130 of which were under consideration in the Bureau, 18 were in the Office of Information awaiting publication by the Department, and the remaining 20 were in press at the Government Printing Office. Of the 130 in the Bureau, 76 were being considered for publication by the Department and the remaining 54 for publication in outside periodicals.

LIBRARY

The use of the Bureau library showed an increase of over 13 percent in the loan and reference work this year.

Several special bibliographies were prepared, among them those on the effect of X-rays on insects, on the effect of infrared rays on insects, on the effect of ultraviolet rays on insect life, and on insect tropisms. The Index to American Economic Entomology and the special indexes in the Bureau library have been brought up to date, and Entomology Current Literature has been issued bimonthly.

A number of very desirable exchanges have been effected through the Barnes collection, and many additions have been made to the collection of photographs of entomologists.

INSECT PEST SURVEY AND INFORMATION

The Survey added to the permanent files on the distribution and abundance of insects 25,100 notes on domestic insects and 11,500 notes on foreign insects, bringing the total now available for consultation to 315,250. There were added 800 species of insects to the existing record of approximately 20,000 species of American insect pests, and the foreign-pest file now contains over 22,000 species. To the host-plant file there were added 25 new genera and 165 new species, bringing the totals to 1,125 genera and 2,600 species.

The monthly Insect Pest Survey Bulletin was augmented by supplements on Alfalfa Weevil Spread in 1938; Alfalfa Weevil Survey, Fall of 1937; Relative Abundance of the European Corn Borer in 1938; Distribution and Colonization of European Corn Borer Parasites in 1938; The Field Status of Parasites of the European Corn Borer in the Fall of 1937; Grasshoppers, Species and Distribution in the 1937 Outbreak; Hessian Fly Survey at Harvest Time, 1938; June Beetles,

Population and Host Preferences in Southern Wisconsin in 1935, 1936, and 1937; and Notes on Tobacco Insects in 1937.

Sixty-nine articles on entomological and quarantine subjects were released to the press, and 68 radio talks were put on the air. Preparation of film-strip material covered 7 new subjects. Two new motion pictures were completed, one on grasshoppers and the other on the Mormon cricket. Both are sound pictures. The Bureau participated in 10 exhibits. One of these, comprising material on barberry eradication, the white-fringed beetle, the European corn borer, the Dutch elm disease, the Japanese beetle, and grasshoppers, was installed in the rotunda of the State Capitol at Jefferson City, Mo., from March 27 through June 2. The attendance during which this material was on exhibit totaled over 66,000.

Cooperative extension work in entomology was supervised under the direction of the Bureau and the Office of Cooperative Extension Work.

Twelve numbers of the Bureau Monthly News Letter were issued, comprising a total of 353 pages. In addition to those sent out on regular mailing lists and miscellaneous mimeographed material, 338,850 copies of publications were distributed.

During the year 2,615 orders for duplicating and photographic material were placed for 1,452,296 copies in all. Of these orders 618 were for photographic work in the Bureau's laboratory, calling for 9,980 prints and negatives. The duplicating work included general Bureau mimeographing, quarantine and administrative instructions, and B. E. P. Q. circulars. Thirty-three mailing lists were maintained in this division.

To the file of photographic prints under the custody of this division there have been added 1,250 new subjects. A total of 1,339 prints have been distributed, on special request, to scientific workers, magazine editors, writers, students, teachers, and others.

FRUIT INSECT INVESTIGATIONS

APPLE AND PEAR INSECTS

Tank-mixed nicotine-bentonite has continued to give very satisfactory control of the codling moth under conditions of severe infestation in southern Indiana. During 1938 this material was used successfully by several Indiana growers throughout most of the season on at least 700 acres. The need for the development of fungicides that will be compatible with nicotine-bentonite and not reduce its efficiency has been further emphasized. Some of the newer copper fungicides have been tested, but either they have interfered with the effectiveness of the nicotine-bentonite in codling moth control, or the combinations have caused serious foliage injury. In other areas the control obtained by the use of the tank-mix nicotine-bentonite has been rather satisfactory except that in some instances the residues have been objectionable and difficult to remove.

Phenothiazine was tested further in southern Indiana, in the Pacific Northwest, and in the Hudson River Valley. For the most part the results were very poor. The reasons for this lack of effectiveness have not been determined. Phenothiazine was found very effective in preventing secondary scab infestation, according to counts made in the Indiana plots by representatives of the Bureau of Plant Industry.

Studies of the influence of particle size, carried on at the Beltsville, Md., laboratory, have indicated that extreme fineness is not necessary for the maximum effectiveness of lead arsenate, calcium arsenate, cryolite, paris green, or phenothiazine in the control of the codling moth. On the other hand, an extremely coarse sample of phenothiazine was much less effective than the materials having either a fine or medium average particle size.

The large-scale field tests of baits carried on at Yakima, Wash., in 10 acres of orchard resulted in the capture of more than 144,000 moths; yet there was very little difference in favor of the baited area in terms of worm injury to fruit at harvest time. Studies carried on in the baited block by means of the release of marked moths indicated that 50 percent of them were being captured in the baits. The removal of this large number of moths from the block must have reduced the moth population materially, and it is believed that the failure to show a benefit was the result of movement of moths from nearby unbaited areas into the experimental block. At Vincennes, Ind., where the results of large-scale baiting tests were somewhat similar, studies of moth movement by means of releases of marked moths and their subsequent recapture in traps showed definitely that a heavy movement of moths into the baited area took place during the summer.

The mechanical-biological project in West Virginia to control the codling moth was continued. The experimental orchard bore a heavy crop of fruit in contrast to last year's very light yield. The proportion of fruit injured by the codling moth dropped from 72 percent in 1937 to 63 in 1938, this being largely the result of the increased number of apples available for worm attack. The percentage of parasitization remained practically the same, whereas the percentage of larvae killed by predators increased from 10.5 percent in 1937 to 12.6 in 1938. Studies of codling moth predators were conducted also at the St. Joseph, Mo., laboratory.

Phenothiazine continued to give control of the apple maggot in the Hudson River Valley, when used either throughout the season or as a final spray following a light program of arsenical applications. Ground cube root failed to reduce apple maggot infestation to any extent, even though five applications were made. Commercial nicotine-bentonite also failed to control the apple maggot in an orchard receiving five applications during the period of adult abundance.

In studies of the common red spider on apple in the Missouri River Valley, data were secured confirming results obtained in 1936 and 1937, viz, that the thorough application of sulfur materials in the calyx and first cover sprays effects a marked reduction in populations, which appears to delay the spider's increase to outbreak proportions by 2 weeks or more.

Further work has been done on the pear thrips on prunes in cooperation with the Oregon Agricultural Experiment Station. In one heavily infested orchard two applications of a 2-percent miscible-oil emulsion with nicotine sulfate gave a yield of approximately 6 tons of fruit per acre as compared with less than a ton from the unsprayed trees.

PEACH INSECTS

Data obtained on the parasites of the oriental fruit moth at Moorestown, N. J., definitely support the prevalent impression that high parasitization of the larvae of the twig-infesting broods is a most important factor in reducing subsequent fruit infestation in mid-season varieties of peaches. In three groups of orchards in which 77, 63, and 51 percent of the twig-infested larvae were parasitized, the harvested fruit was infested 4, 15, and 30 percent, respectively. Mass-liberation experiments associated with this work indicated that early season parasitization can be substantially increased by the liberation of comparatively small numbers of parasites.

Recovery collections, in cooperation with State agencies, were continued as during previous years. The more significant features resulting from this work were that parasitization, particularly of the first brood, increased over any previous year; that the parasitization by *Macrocentrus ancylivorus* Roh. is still increasing; and that the parasitization immediately after the release of *Bassus diversus* Mues. did not increase to so great an extent as in the case of *Inareolata molestae* (Uchida).

Ethylene dichloride emulsion has continued to give effective control of the peach borer with little or no injury to peach trees, in work carried on chiefly near Fort Valley, Ga. Since ethylene dichloride is effective at low temperatures, it can be used both earlier and later in the season than paradichlorobenzene, which requires moderately high soil temperatures for satisfactory results. Because it is easy to apply and is comparatively safe, this material is being rapidly adopted by commercial growers.

In laboratory experiments with the plum curculio conducted during 1938 at Fort Valley, Ga., solutions of dichloroethyl ether gave almost complete kills of the insect in the soil. Similar results were obtained in experiments carried on in cages over peach treees where 1,000 curculio larvae were placed in the soil under each cage. At the strengths used, the treatment caused no apparent injury to the trees.

The work to determine the insects responsible for the transmission of the phony peach disease and peach mosiac has been continued. The surveys carried on with trailer laboratories have indicated a number of insects that there is reason to suspect may be the transmitting agents of these diseases, and this has made necessary the establishment of fixed laboratories to study the host-plant relationships and to conduct transmission experiments with these suspected insects. This work is being carried on at East Chattanooga, Tenn., at San Bernardino, Calif., and at Brownwood, Tex., in cooperation with the Division of Domestic Plant Quarantines and the Bureau of Plant Industry.

GRAPE INSECTS

An all-season treatment with phenothiazine gave a high degree of control of the grape berry moth at Sandusky, Ohio, under conditions of extremely heavy berry moth concentration on a very light crop of grapes.

In cooperation with the Bureau of Agricultural Chemistry and Engineering, experiments were carried on to test the value of a vaporizing

sprayer in controlling the grape leafhopper. This outfit delivers the insecticide by means of a blast of steam requiring comparatively little water. The kill of the insects was definitely inferior to that obtained with the standard power machine. As the quantity of material delivered was increased, the control also increased, but the results did not equal those obtained with the standard power sprayer.

NUT INSECTS

The hickory shuck worm on pecan was found by the Albany, Ga., laboratory to have in part a 2-year life cycle. Fifteen percent of one lot of material that entered hibernation as larvae in 1936 appeared as moths during the second season. This 2-year cycle will enable the insect to bridge over years when a crop of nuts is not available for them. The insect breeds in phylloxera galls before pecan nuts have formed, and develops more rapidly in these galls than it does in pecan nuts. In field experiments nicotine sulfate, nicotine-bentonite, and phenothiazine did not give satisfactory control of this insect.

At Monticello, Fla., a single application of a commercial nicotine-bentonite mixture with summer-oil emulsion apparently reduced an infestation of pecan nut casebearers 69 percent, and a second application gave a control of 81 percent. Field applications of certain of the tar-oil distillates during the dormant period showed reductions in the population of nut casebearers in the first generation ranging from 37 percent for a 3-percent mixture up to 93 percent reduction for a 6⅔-percent mixture.

At Brownwood, Tex., it was found that the nut casebearer feeds extensively on the pecan buds and shoots before turning its attention to the nuts, indicating the necessity for spraying the buds and shoots as well as the nuts. In Florida a number of individuals were reared from eggs to adults on shoots and leaves. This offers a possible explanation of the occasional occurrence of severe infestations following years of nut-crop failure.

Experimental work in Texas during 1938 indicated that the problem of borers in the wounds caused by grafting improved varieties of pecans on native trees was materially aided by the inlay bark graft and the improved grafting waxes developed by the Bureau of Plant Industry. This method results in less borer infestation than the method of top working which has been in general use in Texas. The use of paradichlorobenzene in the grafting wax at the time the top working was done seemed to have no value in borer control. After infestation had taken place, however, the use of additional wax impregnated with paradichlorobenzene was found effective.

The survey work on filbert insects was continued by workers stationed at the Eugene, Oreg., laboratory. The so-called Catalina cherry moth (*Melissopus latiferreanus* Wals.), an important filbert pest, has been found to range in distribution from the Canadian border in Washington to Los Angeles County in southern California. Although the Catalina cherry moth is known to feed on a number of different plants, the survey thus far has revealed it in the Northwest only on filbert, hazel, and oak. In southern California it was reared from oak galls and from the fruit of the Catalina cherry.

DRIED-FRUIT INSECTS

In 1938 the Fresno, Calif., laboratory carried out several schedules for the combined fumigation treatment and shade-cloth protection of dried peaches on the ranch, repeating largely the experiments carried on in 1937. Completely unprotected peaches became 99 percent infested when stored in boxes on the ranch. Similar lots which were fumigated but unprotected by shade cloth also later became about 99 percent infested, indicating that fumigation alone cannot be depended on for protection. The combination of fumigation and shade cloth, however, eliminated practically all infestation. The use of shade cloth appears to be particularly effective immediately following fumigation, as soon as the fruit is boxed from the stacked trays. When cloth is used over the boxes much less is required than when drying fruit in stacked trays is to be protected.

By the use of a mechanical rotary net further information was obtained on the flight habits and seasonal abundance of various insects infesting raisins. Although the saw-toothed grain beetle is one of the predominant species of insects in stored raisins, only 180 specimens of it were captured in the air throughout the entire season. It is evident that this insect does not fly to any extent but moves from point to point by crawling. This suggests the possibility of the use of barriers to prevent the insect from gaining access to the stacks of raisins.

SUBTROPICAL FRUIT INSECTS

Further progress has been made by the Whittier, Calif., laboratory toward the development of a standard laboratory procedure for studies of fumigation for the California red scale that will permit more precise comparisons. The so-called resistant and nonresistant strains of this scale which for several years have been maintained under identical conditions in isolated chambers at the laboratory have continued to maintain their difference in susceptibility.

Two strains of the California red scale, one resistant and the other nonresistant to fumigation with hydrocyanic acid gas, appeared to be about equally susceptible to the action of methyl bromide. The stages of the red scale that are most resistant to hydrocyanic acid gas appear to be the least resistant to methyl bromide. As far as can be determined, the phenomenon of protective stupefaction does not exist with methyl bromide. Promising results have been obtained in preliminary experiments in fumigations with mixtures of hydrocyanic acid gas and methyl bromide.

Field tests of oils with added toxicants, carried on in California in 1938 for the control of the California red scale, confirmed the results of preliminary tests in 1937 and indicated that the addition of nicotine or of cube extract to mineral-oil emulsions caused a marked increase in their effectiveness. This increase in effectiveness from the addition of toxicants seems most evident among the scales on wood, where the oil alone is less effective. Among numerous materials tested as mutual solvents between cube resins and oil, a trichloroethylene dibutyl phthalate mixture was the most satisfactory.

Special attention has been given by the Orlando, Fla., laboratory to the relation of particle size in wettable sulfur and sulfur dusts to

adhesion and control of the citrus rust mite. A 2,000-mesh sulfur dust applied at the rate of ½ pound per tree gave longer protection against reinfestation than the standard 325-mesh sulfur dust at 1 pound per tree. A specially prepared wettable sulfur of 4,000-mesh particle size, used in a spray at 5 pounds per 100 gallons, with or without added adhesives, gave much longer protection than 325-mesh wettable sulfur used at the same rate, or even in twice the amount. No harmful effects were seen on the trees, but further experiments will be needed with these promising new combinations.

In the control of the citrus thrips on lemons in California a sulfur-dusting program which extended through the summer, with reduced quantities of material as the weather became warmer, gave satisfactory control. During the past season only a slight trace of sulfur burn was noted in the test plots. A number of materials other than sulfur have been tested for thrips control. A very effective method of rearing citrus thrips under laboratory conditions has been worked out.

A further determination has been made by the Orlando laboratory that sprays, such as bordeaux mixture or hydrated lime with a sticker, that leave heavy noninsecticidal residues on leaves and fruit increase the populations of the purple scale and Florida red scale. The application of an ammoniacal copper carbonate, which leaves practically no residue, failed to result in scale build-up, and the increase was negligible in trees receiving no sprays.

In May 1939 the Florida laboratory was moved from Orlando to St. Lucie, near Fort Pierce, on the east coast. At that point greater attention will be given to methods of controlling whiteflies and scale insects, especially the Florida red scale. With St. Lucie as headquarters it will also be possible to devote more time to work with the papaya fruitfly and other pests of tropical fruits other than citrus.

JAPANESE AND ASIATIC BEETLES

The work on Japanese and Asiatic beetles has been continued by the laboratories at Moorestown, N. J., and Spencer, N. C. The area infested by the Japanese beetle increased in size about 1,266 square miles during 1938 and now covers approximately 15,117 square miles. The outstanding features of the 1938 season were an unusually light infestation in the oldest infested area, near Philadelphia, a somewhat lighter infestation in much of New Jersey and eastern Pennsylvania north of the Schuylkill River, and the occurrence of extremely heavy infestations in northern Delaware, northeastern Maryland, and southeastern Pennsylvania, as well as a striking increase in infestation in the metropolitan New York area.

Several rotenone-bearing materials were found to have approximately equal value as repellents for adult Japanese beetles. Efforts have been made, but without success, to determine the nature of the ingredient in these materials that is responsible for the repellency.

It was found that the standard bait, containing geraniol and clove eugenol, decreased in attractiveness to the adult beetles during the season after the first week of exposure. The function of the eugenol appeared to be largely to retard the loss in attractiveness of the geraniol itself, rather than to increase its initial attractiveness. The

inclusion of phenyl ethyl alcohol in the formula was found to interfere somewhat with the stabilizing action of the eugenol.

By a recently developed method for the biological assay of soils that have been treated with lead arsenate for grub control, soil from various points in the Middle West, where 1,000 pounds of lead arsenate had been applied a few years ago for grub control, appeared to contain the equivalent of 675 to 800 pounds of freshly applied lead arsenate, indicating a reduction equivalent to the loss of 200 to 325 pounds of lead arsenate. A basic zinc arsenate was found to be only slightly toxic to Japanese beetle larvae.

An investigation on the use of hydrocyanic acid gas as a fumigant for adult Japanese beetles in refrigerator cars was completed, and the dosage requirements for the fumigant at various temperatures from 45° to 75° F. were worked out. A method has been developed for forcing paradichlorobenzene gas rapidly through the soil of balled and potted plants to control the grubs of the Japanese beetle.

The studies of Japanese beetle parasites and their colonization in new areas have been continued by the Moorestown laboratory. About 9,500 *Tiphia popilliavora* Roh. females were collected in the summer of 1938 from 9 established colonies and the material used to provide for the liberation of 64 colonies in Maryland, 18 in Connecticut, and 12 in New York. Efforts to establish the Korean strain have been continued, since it is desirable to have a fall parasite species that will emerge late enough in the season to parasitize third-instar larvae of the Japanese beetle, thus complementing the work of *T. vernalis*, which attacks third-instar host larvae in the spring. In the spring of 1939, 145 colonies of *T. vernalis* Roh. were collected and liberated in 6 States. One colony of the dipterous parasite *Centeter cinerea* Ald. was released in Washington, D. C., in 1938, to determine the synchronization of this species with its host in a more southern area than those in which it had been previously liberated.

The milky diseases, which have received special attention, apparently occur rather generally through much of the older heavily infested area, although they have not been found at points of heavy localized infestation on its outer fringe, or at any point in New England. In experimental field plots first started in 1936 very high disease incidence and almost complete elimination of grubs have occurred.

Because of the difficulty in propagating these organisms in artificial media, it has been necessary to use the bodies of Japanese beetle grubs. A micrometer injection block has been developed with which 2,000 larvae can be inoculated per day. The spores of both type A and type B milky disease, after being stored 41 months in dried-blood films on glass slides in ordinary wooden slide boxes, gave as high infection by puncture inoculation as was obtained when the material was fresh.

A method of holding milky-disease material for subsequent field work has been developed at the Moorestown laboratory. Diseased larvae are ground and mixed with either talc or precipitated chalk, and the mixture is then passed through a 100-mesh sieve. The mixtures may be diluted with water and applied as a spray or mixed with soil and broadcast.

FRUITFLY INVESTIGATIONS

Studies in Hawaii on the vapor-heat method of fruit sterilization have resulted in data permitting the movement of papayas in the regular channels of trade. Heavy populations of the Mexican fruitfly appearing during the past year have been traced to the abnormal production of a second crop of *Sargentia*, a wild native host abundant in northeastern Mexico. Repellent materials discovered both in Hawaii and in Mexico offer a new possibility of protecting fruits from attack. In Puerto Rico a study of the movement of adult fruitfly populations indicates that attack on citrus is largely incidental, depending on the populations which may migrate, and that there is no continuous build-up in citrus.

MEXICAN FRUITFLY CONTROL

The citrus fruit industry in the Rio Grande Valley of Texas had an unprecedented crop of fruit and the largest number of larval infestations on record. The large crop of fruit necessitated a longer harvesting season, and the increased number of larval infestations made sterilization of citrus fruit of prime importance throughout the last half of the shipping season.

INFESTATIONS

Owing to the presence of an extremely large fly population, which apparently drifted into the regulated area from northeastern Mexico during January and February 1939, there developed in later months the most severe infestation of the Mexican fruitfly on record in the Rio Grande Valley. The situation was further complicated by the amount of fruit remaining to be harvested before the beginning of the host-free period, at a time when the fruit movement was delayed on account of poor market conditions.

Early in January traps indicated that flies were moving into the area, and by February it was realized that a serious problem confronted the growers, shippers, and quarantine personnel. Larval infestations were found in the regulated area late in February on 18 premises, in March on 1,404, in April on 704, in May on 3, and in June on 3. These infestations varied in intensity from 1 fruit found infested to as high as 10 percent of the entire crop on many plantings. On individual trees in numerous groves the damage amounted to 80 percent of the crop.

Outside the regulated area nine incipient infestations were found. Seven of these were found in Webb County, one in Dimmit County, and one in La Salle County.

It has long been recognized that the early termination of the harvesting season has a direct bearing on the amount of infestation which develops within the regulated area. When the crop was small enough to be harvested by March 1, little difficulty was encountered; but when production increased to such a degree that a large quantity of fruit remained to be harvested in March and April, infestations usually developed. During the past season it was necessary to extend the period for harvesting grapefruit through May 15, and as an abundance of fruit was available for oviposition, the resulting heavy infestation was not unexpected.

Table 1 shows, for the years 1935–39, the number of infestations in relation to the number of flies trapped and the date the harvesting season closed.

TABLE 1.—*Infestations of the Mexican fruitfly in Texas, 1935–39*

Fiscal year	Flies trapped	Larval infestations	Harvesting season closed	Fiscal year	Flies trapped	Larval infestations	Harvesting season closed
	Number	*Number*			*Number*	*Number*	
1935	367	30	Apr. 2	1938	[1] 712	218	Apr. 30
1936	251	5	Mar. 31	1939	[2] 13,687	[3] 2,141	[4] May 15 [5] June 15
1937	4,714	1,062	Mar. 31				

[1] 79 outside regulated area.
[2] 314 outside regulated area.
[3] 9 outside regulated area.
[4] For grapefruit.
[5] For oranges.

STERILIZATION

Although the infestation within the regulated area was higher during the spring of 1939 than in any other season, at no time throughout the year was the harvesting and shipment of fruit curtailed or seriously delayed. This was due to the fact that unrestricted shipments were permitted after the fruit had been sterilized.

Two types of sterilization were used in 1939, but the high-temperature method accounted for more than 99 percent of the fruit treated. The season opened with only a few rooms for high-temperature sterilization in operation, but more were added rapidly when infestations developed, and by the time the season closed 45 rooms were in operation, with a daily capacity equivalent to 87.2 carlots. Table 2 lists the amount of fruit sterilized monthly by the two approved methods.

TABLE 2.—*Citrus fruit sterilized in Texas* [1]

Month	By high-temperature method		By low-temperature method	Month	By high-temperature method		By low-temperature method
	Grapefruit	Oranges	Grapefruit		Grapefruit	Oranges	Grapefruit
	Tons	*Tons*	*Tons*		*Tons*	*Tons*	*Tons*
February	205.00	----------	----------	May	12,647.00	2.25	2.08
March	4,012.75	----------	----------				
April	27,285.25	----------	----------	Total	44,150.00	2.25	2.08

[1] Total equivalent carlots of fruit sterilized: 3,081.2.

CANNING PLANTS

The canning of grapefruit has continued to occupy an important place in the citrus industry and has become a factor of considerable importance in the enforcement of the provisions of Quarantine No. 64. The season's operations amounted to 12,272 equivalent carlots of grapefruit and 35 equivalent carlots of oranges.

SHIPMENT OF FRUIT

Commercial production of fruit in the regulated area (table 3) increased 12,621 equivalent carlots over the production of the pre-

ceding season. This amount, 47,548.4 equivalent carlots, includes fresh-fruit shipments, fruit processed, and fruit destroyed in the program of the Federal Surplus Commodities Corporation, and represents the highest commercial fruit production in the history of the citrus industry in Texas.

TABLE 3.—*Citrus fruit from the Rio Grande Valley, Tex., shipped and canned, and total production, in equivalent carlots, fiscal years 1933–39*

Fiscal year	By rail		By truck		By boat		By express and passenger car mixed	Canned grapefruit	Commercial production
	Grapefruit	Oranges	Grapefruit	Oranges	Grapefruit	Oranges			
	Carlots	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*	*Carlots*
1933	2,897	230	880	586			101	127	4,821
1934	1,748	114	1,236	877			99	240	4,314
1935	4,617	225	1,731	1,095			239	1,131	9,038
1936	4,262	600	1,454	1,182			267	1,682	9,447
1937	15,616	2,729	2,578	2,351	176	17	532	[1] 6,702	30,701
1938	13,736.3	1,322.7	2,817.4	1,991.5	183.1	4.7	596.1	14,278.6	34,927.4
1939	16,571.6	1,938.5	5,868.3	5,399.3	521.5	12.2	626	[2] 16,611	47,548.4

[1] Includes 2 cars of oranges processed.
[2] Includes 35 cars of oranges processed and 4,304 cars of grapefruit for diversion under the program of the Federal Surplus Commodities Corporation.

INFESTATIONS OUTSIDE OF REGULATED AREA

The discovery of nine incipient larval infestations and the trapping of flies in the counties of Webb, Dimmit, and La Salle necessitated making plans for including these counties in the regulated area. Citrus-fruit production in this territory is small in comparison with that in the regulated area, but it is scattered throughout the three counties.

JAPANESE BEETLE QUARANTINE AND CONTROL

TRAP SCOUTING IN NONREGULATED TERRITORY

During the summer of 1938 the regular trapping program for the Japanese beetle was carried on in 402 cities and towns in 18 States. At the seasonal peak approximately 97,800 scouting-type traps were in operation, and 345 trap inspectors were employed.

Throughout the season beetles were caught at 95 of the trapping points. Only 33 of the catches were first records, the remainder being from sparse infestations carried over from previous years.

Of the 33 first-record infestations, 9 were in Ohio, 8 in New York, 4 in Virginia, 3 each in Indiana, Maine, and North Carolina, 2 in Michigan, and 1 in Iowa. Many of these infestations consisted of 2 or 3 beetles.

From April to July the principal Bureau field stations throughout the United States were utilized in a Japanese beetle trapping survey. The only nonquarantined States not represented in this interdivisional field survey were Arkansas, Nevada, Oklahoma, South Dakota, and Kentucky. The results were negative in Alabama, Arizona, California, Colorado, Florida, Idaho, Kansas, Louisiana, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Mexico, North

Dakota, Oregon, Tennessee, Texas, Utah, Vermont, Washington, and Wisconsin.

In cooperation with the University of Maryland Extension Division and the State entomologist approximately 40,000 traps, the majority manufactured in the Maryland penitentiary, were operated in Maryland during the summer. Trapping there was carried on in 89 cities, towns, and villages. Heavily infested areas were found in Cecil, Baltimore, Kent, Somerset, and Worcester Counties. First-record infestations were found in Jefferson, Lander, Queen Anne, and Ridgeville.

In Atlanta, Ga., 122 beetles were captured in 3,033 traps in 1938, as compared with 6 beetles in 1,487 traps in 1937. One beetle was caught in Savannah. Eighteen localities in the State were trapped, with negative results.

Beetles trapped in Chicago continued to show a decrease. A total of 330 were caught this year as compared with 384 during the summer of 1937. Evanston, Ill., also showed a smaller number (20 beetles in 1937 and 1 in 1938). In Cicero 5 beetles were trapped, as compared with 1 in 1937. The figure for East St. Louis decreased from 3 to 1. No beetles were found in Elgin, where 1 had been found in 1937. Twenty-three additional places in Illinois were trapped, with negative results.

A further decrease was shown for Indianapolis, Ind., where 21 acres were treated with lead arsenate in 1937. Finds decreased from 28 in 1936 to 12 in 1937 and 10 in 1938. The three first-record infestations for Indiana were at East Chicago, Elkhart, and Whiting. One beetle each was caught in Whiting and East Chicago and 2 beetles in Elkhart. The total number of beetles trapped in South Bend, Ind., in 1938 was 8 as compared with 43 in 1937. Twenty beetles were caught in 1,600 traps during 1938 in Fort Wayne. During the previous year half as many traps were used, and 18 beetles were captured. In Logansport, where a single beetle was found in 1937, 8 were trapped in 1938.

The Iowa first record was at Fort Madison, where a single beetle was caught. In each of the six other Iowa towns where traps were operated results were negative.

At Louisville, Ky., 62 beetles were caught in 1,566 traps, an increase from the 10 beetles trapped in 1937. At Lexington 597 traps were placed but only 1 beetle was caught. Approximately 600 traps were used at three other Kentucky points, but no beetles were collected.

First-record incipient infestations were found in Maine at Bath, Brunswick, and Ellsworth. At Bath two beetles were caught; one beetle each was found at Brunswick and Ellsworth. At Bangor three beetles were captured. A single beetle had been caught there in 1935 but none in 1936 or 1937.

During the summer 5,313 traps in Detroit captured 82 beetles. This was an increase over the 67 beetles caught in 5,045 traps in 1937, but still a decrease from the 128 found in 4,686 traps in 1936. First-record infestations were determined at Highland Park, where 2 beetles were caught, and at Pontiac, where a single beetle was found. A single beetle was trapped at Dearborn, a decrease from the 6 beetles of the preceding year.

Twenty-seven beetles were caught in St. Louis as compared with 1 beetle in 1937 and 88 in 1936. Traps set in 5 other Missouri communities failed to collect any beetles.

Of the eight first-record infestations in New York State, the only new infestations of an established nature were at Mount Morris and Brighton. Hornell, Rochester, and Watertown showed substantial increases in beetle collections.

First-record infestations in North Carolina of a few beetles each were recorded at Hamlet, Kinston, and Thomasville. Traps set in 19 other North Carolina communities revealed infestation in 10 cities and negative results in 9 others.

The first-record infestations at Dennison, Dover, and Newark, Ohio, were sufficient to warrant extension of the regulated area. At Ashtabula 397 traps were operated and 126 beetles were caught, approximately equal to the 129 beetles captured in 212 traps in 1937. Collections at Marietta decreased from 121 in 1936 to 45 in 1937 and 19 in 1938.

At Erie, Pa., 2,355 traps were operated and 343 beetles caught, as compared with 149 beetles caught in 1,964 traps in 1937. At Oil City approximately 400 traps in each year yielded 4 beetles in 1937 and 26 in 1938. Sharon showed an increase in beetles from 11 in 1937 to 177 in 1938.

Thirteen communities were trapped in South Carolina, with negative results from 11 towns and cities. The cities trapped with positive results were Charleston and Greenville, where 2 and 6 beetles, respectively, were caught.

In Virginia the 4 first-record infestations were of a few beetles each at Milford, 2 points on State Route 2 south of Fredericksburg, and at Warsaw. At Washington's Birthplace National Monument in Wakefield 7,422 beetles were collected in 300 traps in 1938, an increase over the 7,119 beetles caught in 15 traps in 1937.

Traps were operated at 15 West Virginia towns and cities during 1938; 12 of the communities showed negative results and the other 3 had increases in the number of beetles found. In Charleston a single beetle was caught in 1937, whereas 10 were caught in 1938. Charles Town showed an increase from 1 to 3 beetles, and Martinsburg trap catches increased from 5 to 14 beetles.

Trapping was started in 1939 on April 11 with the setting of traps at Presidio, Tex. On June 30 traps were in operation in 219 cities and towns in 34 States.

During May and June beetles were collected at locations in 31 towns and cities in Georgia, Illinois, Kentucky, Missouri, North Carolina, Ohio, and South Carolina. Nineteen of these towns and cities are in North Carolina. A single beetle caught at Martins Ferry, Ohio, was a first record. Six beetles were captured in Marietta, Ohio; 139 in Atlanta, Ga.; 8 in East St. Louis, Ill.; 5 in Louisville, Ky.; and 10 in St. Louis, Mo. Included in the North Carolina finds were 1 beetle in Hamlet and 1 in Thomasville, 2 of the 3 locations of first-record infestation in North Carolina discovered during the 1938 season. Beetles in considerable numbers were captured in 4 North Carolina towns and cities which were not trapped during the summer of 1938. These towns and cities and the approximate beetle finds during May and June 1939 were as follows: East Spencer, 500; Greensboro, 200; Spencer, 300; and

Winston-Salem, 600. One beetle was caught in Milford, Va., the scene of 1 of the 4 first-record infestations in Virginia during the summer of 1938.

SUPPRESSIVE MEASURES

Soil-treatment programs were carried out in Georgia, Illinois, Indiana, Kentucky, Michigan, Missouri, New York, North Carolina, Ohio, Pennsylvania, and Virginia.

Field treatments were resumed in Atlanta, Ga., on September 7, and 35.2 acres received lead arsenate applications. Additional lead arsenate was applied to 15.8 acres between January 29 and February 15.

In Chicago 143.6 acres were treated between July 1 and October 19. Work on 52.8 additional acres was begun on May 22.

In Indiana, at Fort Wayne, 20.1 acres were treated; at Indianapolis, 6.5 acres; and at Logansport, 16.1 acres.

At Louisville, Ky., lead arsenate was applied to 35 acres.

Approximately 18 acres were treated in Detroit, Mich.; in Dearborn 13.5 acres received the lead arsenate treatment, and 1.2 acres were treated at Highland Park.

In St. Louis, Mo., 40.8 acres were treated.

Nurserymen in the Newark, N. J., area were responsible for the treatment of 1.6 acres in that city.

Lead arsenate applications at the principal Japanese beetle infestations discovered in North Carolina during the last few years were started in Greensboro and Winston-Salem on March 27. In Greensboro 69.7 acres were treated, in Winston-Salem 50.4 acres, and in Spencer 34.1 acres. Approximately 86 acres were treated at eight other North Carolina points, as follows: Charlotte, Durham, East Spencer, Elizabeth City, High Point, Raleigh, Sanford, and Wilmington.

At Marietta, Ohio, treatment was resumed on June 23, and 6 acres were treated. At Belpre lead arsenate was applied to 1.5 acres. Seventeen acres were sprayed at Ashtabula, Conneaut, and Mentor.

Field treatments were resumed on October 17 at Erie and Oil City, Pa. The work at Erie covered 81.1 acres, and at Oil City 16 acres had been treated when the work was completed on November 3.

At Winchester, Va., 10.2 acres were treated, and at Harrisonburg 2.1 acres received the treatment.

A total of 775 acres received the lead arsenate treatment at the places named. All the soil-treating projects were sponsored by State, city, or other agencies, with the Bureau furnishing the spray equipment, operators of the trucks, and supervisors to cooperate with the men designated by the States to supervise the labor.

FEDERAL AND STATE REGULATORY MEASURES

Administrative instructions dated September 19, 1938, advanced the date for termination of the restrictions as to fruits and vegetables from October 16 to September 20.

Revised quarantine regulations were issued, effective February 20, 1939. Nominal extensions were made of regulated areas in Maryland, New York, Pennsylvania, Virginia, and West Virginia, together with a more extensive increase in the Ohio regulated area. The revision also added parts of several counties in Pennsylvania and Mary-

land to the special area from which the movement of fruits and vegetables by motortruck or refrigerator car is regulated. Several isolated points in New York and Pennsylvania were placed under regulation, but no restrictions were placed on the movement of fruits and vegetables from these special areas. Fruit shippers were further relieved from restrictions on the movement of commercially packed peaches and of bananas in single bunches packed in commercial containers, unless they were moved by refrigerator cars or motortruck from the heavily infested area.

Revisions of existing intrastate Japanese beetle quarantine regulations were issued by the States of Missouri, North Carolina, Ohio, Pennsylvania, and Virginia.

HIGHWAY INSPECTION SERVICE

To meet the peak-month requirements for highway inspection of quarantined products, three stations were added in July to those already in operation at the end of the preceding fiscal year. By August 1, 1938, 39 roads were posted. Twelve of these were in Virginia, 6 in West Virginia, 10 in Ohio, and 11 in Pennsylvania. The highest number of road inspectors employed during the summer was 84.

Toward the end of August the first of the regular stations was closed for the season. As road traffic in quarantined products decreased, additional stations were abandoned. The last of the stations, that on U. S. Route No. 1, near Fredericksburg, Va., was closed on November 15.

In the spring of 1939 highway inspection began during the first week of April with the opening of 5 stations in Virginia and 2 in West Virginia. Later in the month 9 stations were posted in Ohio and 1 in Pennsylvania, bringing the total on April 30 to 17.

One station was opened in May, and 9 additional on June 15, when the seasonal restrictions on fruits and vegetables went into effect. All the 27 road stations were being operated at their maximum by the end of the month, manned by a total of 75 inspectors. Virginia had 14 stations, West Virginia 2, Ohio 10, and Pennsylvania 1.

Approximately 7,720 live adult beetles were found in empty trucks which were returning to southern points after having made deliveries in heavily infested northern sections. One truck that was on its way back from New York was found to have 234 beetles. On another truck from the same city 213 beetles were found.

Ninety-one lots of infested plant material were intercepted. From this plant material 26 adult beetles, 4 pupae, and 188 grubs were removed.

Counts of all motor vehicles stopped at the road stations for inspection totaled 4,897,793. Of this number, 26,382 were found to be carrying uncertified quarantined products.

CERTIFICATION AND TREATMENT OF NURSERY STOCK

Continued build-up in beetle population was again responsible for additions to the number of classified nurseries and greenhouses found to be infested with the Japanese beetle. In New England beetles were found on the grounds of 71 nurseries and greenhouses in Connecticut, 4 in Massachusetts, 1 in New Hampshire, and 1 in Rhode Island. The

other States in the regulated area reported nursery infestations as follows: Delaware, 8 establishments; Maryland, 72; New Jersey, 6; New York, 39; Ohio, 1; Pennsylvania, 26; Virginia, 27; and West Virginia, 2. A total of 5,562 beetles were found on the grounds of these 258 establishments. In addition, beetles totaling 673 were found within 500 feet of the grounds of 61 other establishments in the regulated area.

Fewer nurseries were rescouted in 1938 than in 1937, when this practice was inaugurated. In 1937, 67 establishments were rescouted; in 1938, 7. Of the latter number, 3 were found uninfested and were again assigned to the preferred status. Infestations on the other 4 properties were found to be limited to a portion of the nursery, giving these establishments at least a small area of preferred classification from which stock might be shipped without treatment.

Nursery and greenhouse scouting was completed during the third week in September.

On September 23, 10 live Japanese beetles, feeding on grape foliage in Elmira, N. Y., were found by an inspector in the course of special checking to determine how late beetles might be found in that section. An inspector brought in a live male beetle on November 8, collected on zinnia at Rumson, N. J. Another "last" beetle was found November 7 on a rose growing in a yard in Swarthmore, Pa.

Throughout most of the Japanese beetle regulated area large quantities of nursery products moved under certification for many of the quarantined States. Forty-two carloads of certified stock were shipped from New Jersey in March.

A number of temporary inspectors were added to the field force during March to take care of an increased demand for Japanese beetle inspection and certification of nursery and greenhouse stock. Five were employed to examine nursery stock shipped from the Newport, R. I., and Manchester, Conn., districts. With the arrival of Memorial Day the greater part of the spring nursery-inspection work was completed in the New England area. Only 1 of the 13 temporary inspectors employed in this work was retained after May 31. Throughout the area more shipments and a larger quantity of plants were presented for inspection and certification than for several years.

Numerous tests of methyl bromide as a fumigant for potted plants were conducted at commercial establishments during the winter of 1938–39. The tests were highly successful. As a result, methyl bromide fumigation was authorized, effective February 15, for potted plants, plants in tubs, or balled nursery stock with soil masses up to 8 inches in diameter. This new procedure is a decided boon to nurserymen. It is cheaper than either the carbon disulfide emulsion or paradichlorobenzene treatment. Nurserymen enthusiastically welcomed the new procedure as a simplification of fumigation methods for plants accompanied by soil.

A revised edition of the Shipper's Guide, enlarged to contain the cities and towns added to the regulated area with the revision of the regulations effective February 20, 1939, was distributed during the first part of May.

A total of 909 soil samples was collected from 99.96 acres of nursery plots, heeling-in areas, and frames treated with lead arsenate.

The Division of Insecticide Investigations analyzed these samples, and when a deficiency of lead arsenate was indicated, new applications of the poison were made to the areas showing the need for it. Throughout the Japanese beetle regulated area the re-leading of nursery plots was approximately one-half of the acreage treated in 1938. The analyses indicated very little loss of lead arsenate content during the year in those plots where the dosage was up to requirements last year. A number of the treated plots are being abandoned in favor of the methyl bromide fumigation of nursery stock. Initial applications were made to 10.97 acres of nursery plots and heeling-in sections.

A small increase was shown in the number of commercial establishments conforming to the requirements for classification. Class I listed 1,926 of these establishments, class III had 576, and the remaining 18 were in an intermediate classification. The number of uninfested nurseries increased by 89, but there was a net decrease of 96 in the number of infested properties.

Traps set in the Norfolk, Va., area to indicate early emergence for 1939 caught one beetle on May 29.

CERTIFICATION OF FRUITS, VEGETABLES, AND CUT FLOWERS

A maximum force of 177 men inspected farm products in the regulated area during the period of adult beetle flight in 1938. Forty-two inspection centers were in operation. Eight were in Delaware, 8 in New York, 6 in Maryland, 5 in Virginia, 4 in New Jersey, 2 in Massachusetts, 2 in Pennsylvania, 1 in Maine, 3 in Ohio, 1 in the District of Columbia, 1 in Connecticut, and 1 in West Virginia.

The heavy flight of Japanese beetles in July in the New York City district necessitated the fumigation of refrigerator cars loaded with bananas. This was the first time such a measure was necessary in the area. During July 262 loaded cars were fumigated with methyl bromide.

The flight of Japanese beetles in the Baltimore, Md., area was the greatest in years. More beetles were found on shipments of farm products and cut flowers in 1 day during July than in the entire inspection period of 1937.

Prefumigation and screening of refrigerator cars used to haul products from the generally infested section were discontinued September 10. The seasonal restrictions on fruits and vegetables were removed September 20. The restrictions on the movement of cut flowers continued in effect, however, until October 15.

During the period of the quarantine on fruits, vegetables, and cut flowers, inspectors removed 1,660 adult beetles from 5,087,088 packages of commodities certified for inspection.

CERTIFICATES ISSUED, VIOLATIONS INVESTIGATED, AND PROSECUTIONS TERMINATED

A total of 553,804 certificates of all kinds were used to cover quarantined products moving to nonregulated territory during the year.

Table 4 shows the quarantined articles, intended for shipment from the regulated area and for use in certified greenhouses or surface soil in nursery plots, in heeling-in areas, or in plunging areas, which were fumigated or sterilized during the 12-month period.

TABLE 4.—*Materials fumigated or sterilized under Japanese beetle quarantine regulations, fiscal year 1939*

Treatment	Plants	Potting soil	Sand	Surface soil	Surface soil with plants	Berries
	Number	*Cubic yards*	*Cars*	*Square feet*	*Square feet*	*Crates*
Lead arsenate	48, 543			550, 394	122, 406	
Carbon disulfide	4, 564	2, 775	37	21, 560		4, 868
Paradichlorobenzene	75, 587					
Naphthalene		80		39, 089		
Steam		509		17, 352		
Hot water	74					
Electricity		47				

Treatment	Plants	Potatoes	Sweet-potatoes	Onions	Tomatoes	Mixed shipments	Empty cars
	Number	*Cars*	*Cars*	*Cars*	*Cars*	*Cars*	*Number*
Methyl bromide	302, 388	5, 596	61	64	8	3	2
Hydrocyanic acid		81	1	55	3	1	5, 629

Treatment	Apples	Bananas	Carrots	Cucumbers	Egg-plant	Peppers
	Bushels	*Cars*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Methyl bromide						
Hydrocyanic acid	75	633	25	50	129	1, 331

Nursery and ornamental stock, sand, soil, earth, peat, compost, and manure were certified for shipment from class III establishments in the regulated area in the following quantities:

Plants	number	33, 056, 496
Sand, earth, and clay	carloads	1, 815
Peat	pounds	24, 352
Grass and stolons	square feet	3, 612
Manure and compost	carloads	3

Fruits, vegetables, and cut flowers certified during the seasonal quarantine on these articles were as follows:

Fruits and vegetables	packages	5, 016, 025
Cut flowers	do	71, 063

A total of 248,586 shipments were made by class I establishments to points in nonregulated territory and between establishments in the regulated area.

Investigations were made of 2,250 apparent violations of the Japanese beetle quarantine regulations. Convictions were secured for four of these violations. Three of them covered as many truckloads of uninspected sweetpotatoes intercepted at Rochester, N. Y. In the fourth case beetle infestation was found in the soil accompanying an uncertified forsythia plant intercepted at Los Angeles by an inspector of the California Department of Agriculture.

COOPERATIVE ENTERPRISES

State funds for cooperative control or quarantine activities were provided by Connecticut, Delaware, Georgia, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia.

Total contributions from Federal welfare, State, city, and other agencies for labor and material used to set and remove traps were approximately $27,670 for the year; for soil treating, about $110,000.

Experiments to determine the effectiveness of the nematode *Neoaplectana glaseri* in controlling established infestations of the Japanese beetle were continued at White Horse, N. J., under the joint cooperation of this Bureau and the New Jersey Department of Agriculture.

Lead arsenate and labor for its application were supplied through a $30,000 appropriation by the State Assembly of North Carolina. In addition, $60,000 was appropriated for the succeeding biennium for soil poisoning in the State. For the first year of the biennium $35,000 was allotted, and for the second year $25,000, making a total of $90,000 appropriated by the 1939 General Assembly for Japanese beetle soil treatment in the State.

CONTROL OF PEACH MOSAIC AND PHONY PEACH DISEASES

Funds for prosecuting the peach mosaic and phony peach control projects were derived from regular appropriations, supplemented by substantial emergency-relief allotments and contributions from the States, the latter of which nearly equaled regular Federal appropriations.

Almost 16,000,000 orchard trees on more than 145,000 properties were inspected. In excess of 147,000 diseased trees were found, more than 120,000 of which were destroyed. While comparisons with previous years' findings are difficult, there is evidence of substantial reductions in incidence of new cases of these two diseases.

With labor employed with Emergency Relief Administration funds, between 9 and 10 million escaped and abandoned trees were removed to prevent their becoming harboring places for these diseases and to eliminate the necessity for subsequent inspections.

Inspections were conducted in 455 counties in 24 Southern States from the Atlantic to the Pacific. Four additional counties were found infected with mosaic and 7 with phony peach disease for the first time.

During the last quarter of the year inspections were made of nurseries and budwood sources and their environs. Nearly 700 nurseries growing more than 26 million trees were involved. In the States infected with phony peach all diseased trees were removed from all nursery environs before June 30, thereby complying with all requirements for certification under the standard State quarantines. In the mosaic area 31 nurseries and 7 dealers' sales yards failed to meet the requirements of the quarantines and were barred from shipping nursery stock. Most of the latter nurseries were producing stock for home use only. Cooperation was continued in assisting States in the enforcement of their standard quarantines relative to these diseases.

In cooperation with the Colorado State Department of Agriculture, a series of "off" variety peach trees were grafted with scions from

known healthy but susceptible varieties with a view to determining whether the grafted trees might be symptomless carriers. The practicability of this method of inspection will not be determined until the present crop season is over.

During the year 147 Bureau and 69 State inspectors were employed on the project, in addition to an average of nearly 650 relief workers.

After the 1939 inspection season the States of Maryland and Oklahoma were released from the area quarantined on account of phony peach disease, since no diseased trees were found by inspection during a period of 3 years of properties previously known to have been infected, and contiguous properties. Many counties in other States were also eligible for removal from quarantine. However, no action was taken by the States to remove these counties from quarantine, since all nurseries therein could comply with the quarantine-certification requirements.

CITRUS CANKER ERADICATION

Repeated and thorough inspection work was conducted in areas in Louisiana and Texas in which citrus canker had been found since the intensive survey of 1935, and the program was extended to include a number of additional counties. One recurring infection and one infection on a property in which disease had not previously been detected were found in Brazoria County, Tex. The 106 infected trees in these areas consisted of small seedlings, which in the case of the property not previously known to be infected had been cut off by a mowing machine. The discovery of infection under such circumstances is indicative of the thorough and intensive nature of the inspection program.

The employment of relief labor from allotments from emergency-relief appropriations made possible the removal and destruction of over 2,000,000 escaped and abandoned citrus trees, a large majority of which were *Citrus trifoliata* seedlings. This type of work is a very essential part of the eradication program, since it results in elimination of escaped and abandoned trees that might harbor the disease.

INSECTS AFFECTING FOREST AND SHADE TREES

PROGRESS MADE IN THE CONTROL OF BARK BEETLES

WESTERN PINE BEETLE

Recent studies in the commercial pine forests of California and Oregon have emphasized the development of methods of classifying forest stands as to their relative susceptibility to attack by bark beetles. It is believed that the danger of serious outbreaks may be greatly reduced by making forest stands more resistant to attack through selective cutting of high-risk trees and by giving priority in logging programs to areas of greatest beetle hazard. Large tracts of forest land have been surveyed and zoned as to relative degree of hazard, and it is planned to complete this work over practically all the commercial pine area. This information is of direct value to the Forest Service, the Office of Indian Affairs, and those owning large tracts of timber in planning their sales and cutting programs.

Much of the high-quality lumber in the commercial pine stands of northeastern California is contained in overmature trees, in varying

stages of deterioration due to poor growth and injury from certain forms of insect activity. It is considered that the prevalence of such trees serves as a breeding ground for endemic western pine beetle infestations which at times develop into epidemic outbreaks. Logging of trees infested with *Dendroctonus* beetles as a combined control and salvage measure has been tried at various times during the past decade by private timber-holding companies in these areas. Some control has been secured by the operations, but values of the salvaged material were seriously affected by degrade due to rapid development of blue stains in the logs following attacks by the beetles.

Results of the salvage projects led to the theory that logging highly susceptible but living trees before they could be infested by *Dendroctonus* beetles would be more effective both for control and salvage. This method offers two decided advantages over logging only infested trees: (1) The lumber product would not be blue-stained, and (2) those trees in which beetle populations breed up would be removed, and an indirect control effect would be secured against further outbreaks. In 1939 the California Forest and Range Experiment Station initiated logging of high-risk trees on its experimental forest of 10,000 acres in the Lassen National Forest. This operation was planned as an adequate test of the foregoing theory. In the spring of 1939 one of the larger lumber companies, acting on information supplied by the Bureau of Entomology and Plant Quarantine, followed suit. Plans of the company have been based on detailed information regarding those areas where high insect hazards exist and on estimates of the volume of high-risk trees that should be removed.

Both these logging projects are being followed with detailed studies to check on their control efficiency. Plots have been established in both treated and untreated areas, which will be observed for a period of years to determine the effect of the logging upon subsequent beetle infestation. These plot studies will show what trees die, what relative losses occur on treated and untreated areas, what types of trees should be removed, and what types of trees will be most likely to survive if left in the reserve stand. The operation of the private company will be more extensive than that on the experimental forest and will provide reliable cost data. Only the best of modern caterpillar and truck logging equipment will be used, and experienced woods laborers will be employed. The company plans to follow log grades of high-risk material through the mill and will make a comparison of the yield of values from this material with that from similar stands logged by the usual methods of cutting.

MOUNTAIN PINE BEETLE

Present methods of reducing outbreaks of the mountain pine beetle in lodgepole pine involve the use of fire. This practice is in many instances destructive and entails considerable expense in combating those fires which inevitably get out of control. To avoid the danger associated with the use of fire it has been necessary to conduct control projects at a season of the year when such operations are most expensive. To eliminate this objection to an otherwise satisfactory method of control, experiments have been conducted to develop a spray which, when applied to the bark of standing infested lodgepole pine, would penetrate the bark and destroy the overwintering

insect broods beneath. These tests were so successful that during June 1939 an experimental control project was conducted on the Grand Teton National Park in Wyoming.

BLACK HILLS BEETLE

The Black Hills beetle is the most destructive forest insect in the central Rocky Mountain region. Since 1935 it has caused widespread losses in lodgepole, limber, and ponderosa pines, and in many areas has already destroyed more than 80 percent of the trees over 6 inches in diameter at breast height and all trees over 18 inches in diameter. The volume of losses caused by this insect during the past 5 years is seven times as great as the total fire losses and nearly as great as the total volume of timber cut in Wyoming, Utah, and Colorado. The timber cut during this period in these three States was about 465 million board feet.

The treating of over 50,000 ponderosa pine trees for control of the Black Hills beetle in the central Rocky Mountain region during the year brings the total for the last 5 years up to nearly a quarter of a million trees. The bark beetles built up to epidemic conditions during a period of severe drought and correspondingly poor tree growth. These outbreaks have been fought vigorously and effectively to save the scenic and commercial stands of pine in the region from further devastation. The actual treating was done by the Forest Service, the National Park Service, and the Denver Mountain Parks Improvement and Protective Association under the technical supervision of this Bureau. At present it appears that in practically all the areas where control work has been conducted the heavy epidemic centers have been reduced to an endemic condition. However, there should be no let-down in the vigilant watch for possible new centers of infestation.

OTHER FOREST INSECT PROBLEMS

HEMLOCK BORER

A preliminary investigation in 1937 disclosed that about 100 million board feet of hemlock had died in stands on the Menominee Indian Reservation in central Wisconsin since 1930. At the same time it was apparent that most of the trees had been infested by the hemlock borer. In June 1938 a study was begun to determine whether the insect is primary or secondary and whether any control measures are practical. From the first season's observations it can be definitely stated that the hemlock borer is secondary, since it can successfully attack and reach maturity in only those trees that are weak or dying. Incipient borer galleries in wood laid on as early as 1902 indicate that this insect has been present in these stands for many years. It could not, however, develop an epidemic population until severe heat and drought conditions from 1931 to 1937 and several severe blowdowns had made conditions favorable for successful attack and a rapid increase in population. General observations in the spring of 1939 indicate less mortality of trees this year than last, due, it is believed, to the abundant rainfall and favorable growing conditions in 1938. However, more than one rainy season will be needed to alter noticeably the condition created by the prolonged period of dry years.

EUROPEAN SPRUCE SAWFLY

An intensive survey was conducted during the summer of 1938 in New Hampshire, Vermont, and New York to determine the status of the European spruce sawfly. In cooperation with State agencies all the principal spruce areas in these three States were inspected. Generally speaking, the survey showed that the spruce sawfly was present wherever inspections were made, but only four areas of heavy infestation were found. Two of these were in southern New Hampshire, one in central Vermont, and one in southern Vermont. In 1937 heavy infestations were located in northern Maine and reports from that State in 1938 indicated an increase.

In cooperation with the Society for the Protection of New Hampshire Forests between 5 and 6 million cocoon parasites (*Microplectron fuscipennis* (Zett.)) were reared in 1938. Colonies of this European parasite were liberated at every locality in New Hampshire, Vermont, and New York where sufficient larvae were found to indicate the possibility of successful establishment of the parasite. In Maine large numbers were also reared and liberated by State agencies.

Eleven species of sawfly parasites were received in small numbers from the Canadian Government. About half these were liberated in heavy sawfly infestations; the remainder were held for experimental work in laboratory rearing. Small numbers of four species of larval parasites and one cocoon parasite were successfully reared, but none of the species appears particularly adapted for large-scale propagation.

In the spring of 1939 an intensive study of the sawfly and the factors influencing its abundance was undertaken. Permanent sample plots were established throughout the Northeast to determine the effects of defoliation on different species of spruce, the differences in life history of the insect under varying climatic conditions, and the fluctuation in population from generation to generation.

INSECTS IN RELATION TO THE DUTCH ELM DISEASE

Collections of adults of the bark beetles *Scolytus multistriatus* Marsh. and *Hylurgopinus rufipes* (Eich.) that were attracted to felled elm trees have been made uniformly from six points in New Jersey during 1936, 1937, and 1938. These bark beetles were cultured to ascertain the percentage carrying the Dutch elm disease fungus (*Cerastomella ulmi* (Schwarz) Buisman). The records are given in table 5.

TABLE 5.—*Numbers and percentages of the two elm bark beetles collected that carried the Dutch elm disease fungus*

Year	*Scolytus multistriatus*		*Hylurgopinus rufipes*	
	Collected and cultured	Carrying *Ceratostomella ulmi*	Collected and cultured	Carrying *Ceratostomella ulmi*
	Number	*Percent*	*Number*	*Percent*
1936	7,209	6.9	139	4.3
1937	9,706	5.8	612	2.5
1938	33,192	7.7	274	3.3

The large increase in numbers of *Scolytus multistriatus* collected in 1938 may be attributed to a marked increase in the available breeding material in the field. The amount of such material has been much reduced in 1939, and it is hoped that further increase in the beetle population will be checked. It will also be noted that there was an appreciable increase in the percentage of both species of beetles carrying the fungus in 1938 over that in 1937.

Laboratory and field studies have revealed that adults of *Hylurgopinus rufipes* frequently bore through the bark of living elm trees and contact the xylem. Much of this activity apparently takes place early in the spring before the spring vessels of the elms are mature and when chances of inoculation are less likely to occur. This partly explains why *H. rufipes* is less important as a carrier of the fungus than *Scolytus multistriatus*.

Water solutions of sodium arsenite, copper sulfate, ammonium bifluoride, copper nitrate, and copper chloride have been found effective in killing elm trees. When these solutions were injected into living trees in a foliar condition, they were effective in controlling attack by *Scolytus multistriatus* and *Hylurgopinus rufipes*. Copper sulfate solution has been used more than the other chemicals mentioned, and this at 60 grams per inch diameter (based on dry weight of the salt) on trees up to 12 inches in diameter at breast height.

Preliminary studies have indicated that a combination spray of lead arsenate and lime-sulfur when sprayed on elms in foliar condition is effective in repelling *Scolytus multistriatus* from feeding in the crotches. Some measure of success has been secured in killing bark beetle broods in elm logs by spraying the logs with fuel oil plus orthodichlorobenzene and fuel oil plus naphthalene.

GYPSY AND BROWN-TAIL MOTH CONTROL

Late in September 1938 the New England area, which is heavily infested with the gypsy moth, was visited by one of the most severe hurricanes in its history. This climatic disturbance resulted in dislodging many egg clusters of the gypsy moth, and it is possible that large numbers of them were carried, in whole or in part, by the tremendous force of the wind to territory heretofore uninfested by this insect. (The same may be true in connection with distribution, for short distances at least, of brown-tail moth webs that had already been spun at the tips of the trees in the infested area.) The wind-blown trees afforded general protection for the insect during the winter, and the snow cover was ample to provide protection in latitudes where extremely low temperatures prevailed.

This ground condition impeded the progress of scouting and clean-up work for control of this pest and added materially to its cost. Fortunately the acreage where trees were blown down in the barrier zone was confined to limited areas, but the territory east of it, particularly in the Connecticut River Valley and on toward the seacoast, not only suffered the greatest damage but furnished conditions favorable for continued infestation.

Throughout the year effective cooperation has been maintained with the State officials, the C. C. C. organization administered by the Forest Service, and the Government officials of Canada in dealing

with small gypsy moth infestations that occur on both sides of the international line at Calais, Maine, and St. Stephen, New Brunswick.

In July 1938, assembling cages used for attracting male gypsy moths were set up as follows: 2,097 in 32 towns immediately surrounding the infested area in Pennsylvania (these were put out and patrolled by Bureau employees); 498 in 17 towns in New Jersey, surrounding the location where the gypsy moth was last found in that State and along the New Jersey, Pennsylvania, and New York State lines. These were put up and patrolled by State employees. In New York 4,476 were placed in 28 towns between the Hudson River and the New Jersey and Pennsylvania lines. They were put up and patrolled by State and Bureau employees. From the total, 7,071 cages, 23 male moths were caught at 7 cages in 6 towns in Pennsylvania, and at 1 cage in a town in Ulster County, N. Y. The cages in Pennsylvania were all in towns that had been infested previously. Since that time the surrounding area has been scouted. Five small infestations have been found and treated, and in the other town no infestation was discovered. In New York scouting covering an area of approximately 2 miles surrounding the cage failed to indicate any infestation. During July 1938 material was secured for use in charging assembling cages in the summer of 1939; 8,025 charges were obtained and held in cool storage (35°–40° F.).

During the same month an attempt was made to determine the feasibility of estimating defoliation by using an autogiro. Territory was surveyed in several counties and the degree of infestation noted on topographical quadrangles. This method appears to give sufficient promise to warrant its continuance on a larger scale in the future. In the summer of 1937 the acreage defoliated was the highest ever recorded, aggregating 608,760 acres. In July 1938, after the records taken by ground and autogiro observation were combined, the total aggregated 393,613 acres. There was a large decrease in Massachusetts and some decrease in New Hampshire and Maine. Moderate increases in acreage occurred in Vermont, Rhode Island, and Connecticut. No defoliation was recorded in New York, New Jersey, or Pennsylvania.

In continuation of work inaugurated in 1936 relative to studying possibilities of autogiro use in gypsy moth control, an aircraft of this type was purchased and equipped with insecticide-distributing apparatus of a design resulting from these studies. This equipment was used in June 1939. Lead arsenate and fish oil, which were carried in separate storage compartments in the giro, were mixed as they were forced from the machine. One hundred acres of woodland were sprayed. Preliminary results appear to be satisfactory. These must be checked after the foliage is down. The distribution of the poison on the foliage was more uniform than has been noted previously with insecticides released from airplanes. It was evident that the equipment must be improved in order that all the poison released will be mixed with the fish oil, and work along this line is being continued.

Wind dispersion of small caterpillars of the gypsy moth is the greatest danger to the maintenance of the barrier zone. For a number of years records have been taken in and near it covering the temperature and the direction and velocity of the wind during the period when the caterpillars are small enough to be blown to new

locations. By correlating these records and using the field-scouting data secured in the control work, the conclusion has been definitely reached that during the last 2 years weather conditions coupled with severe infestation in the Connecticut River Valley have been unusually favorable for wind spread toward the north and northwest. In scattered locations in the zone many colonies of a single egg cluster have been found that could not have become established in any other way.

A relatively small amount of work has been done on the brown-tail moth, although contact has been kept with the State and local organizations working on this problem. In some sections of Maine, New Hampshire, and Massachusetts, the only States now known to be infested, this insect has been destructive, and there has been a general increase in abundance during the year.

The regular appropriation of $275,718 supplemented by W. P. A. work-project allotments of $945,970, provided funds for the continuation of Federal gypsy moth control work. The regular funds were $25,000 less and the W. P. A. allotments approximately $351,000 less than were provided for gypsy moth control in 1938. With the W. P. A. funds available in 1939 an average daily force of 1,162 workers was employed, practically all of whom were drawn from relief rolls.

SCOUTING AND TREATMENT FOR THE GYPSY MOTH

As a result of intensive check-up work at sites of infestations discovered in the New England section of the barrier zone and in Pennsylvania during the fiscal year 1938, it was determined that 50 infestations had been exterminated in the Massachusetts portion of the zone area, 32 in the Connecticut section, and 89 in the Pennsylvania area, a total of 171.

Sites of infestations located in 1938 in the towns of Calais and Princeton in Washington County, Maine, were intensively scouted by a small force of experienced employees. No evidence of the gypsy moth was found in Princeton, but three small infestations were located and treated in Calais. In cooperation with the authorities of the Dominion of Canada responsible for pest-control work, these infested sites were sprayed in June 1939.

Work in Vermont was confined to the barrier zone and to a few towns east of Rutland where the danger of wind spread into the zone seemed greatest. Forty-one infestations aggregating 47 egg clusters were found in 6 towns in Addison County. This indicates that in the spring of 1938 there was considerable wind spread of young caterpillars from heavily infested areas near the Connecticut River up the White and Black River Valleys and into the barrier zone. One high-power sprayer was used in June in treating several infestations on high elevations in towns adjacent to the zone east of Rutland. The Connecticut River Valley towns in Vermont and New Hampshire are heavily infested from the Massachusetts State line approximately 100 miles north to Newbury, Vt. Within this territory extensive areas of heavy feeding have been observed this year.

In Massachusetts 65 percent of the W. P. A. field force was employed in the barrier zone in Berkshire County. The remainder of the work was done in selected areas, most of which were adjacent to the zone in

Franklin, Hampshire, and Hampden Counties. About the same number of infestations were found in the zone area as in 1938, but all were small, and the total number of egg clusters destroyed was less than one-half the number treated last year. Although fewer egg clusters were located east of the zone than previously, most of them were in lightly infested territory but were on high elevations, which are favorable for wind spread. Nine of the fourteen sprayers assigned to the Massachusetts area were used in the barrier zone, and the remainder were needed to treat serious infestations adjacent to the zone. Infestation between the zone and the Connecticut River is heavy, particularly in towns near this river, where several large areas were defoliated this year. Such infestations west of the river menace the barrier zone.

Practically all work in Connecticut was confined to the area of the barrier zone. Although more infestations were discovered there than in 1938, the total number of egg clusters located and treated was 55 percent less than the total destroyed last year. Twelve high-power sprayers were used this year. Late in June the State entomologist reported an isolated infestation within the zone in the town of Southbury. The pest was abundant, and a few trees showed noticeable feeding at the time the discovery was made. As it was too late to spray effectively, burlap was applied to the trees and caterpillars and pupae were crushed.

In New York intensive scouting and treating work was done by Federal W. P. A. forces, C. C. C. camp enrollees, and regular State employees supervised by the New York Conservation Department. Serious isolated infestations discovered near the zone in Shawangunk, Ulster County, and Hague, Warren County, in 1937 and 1938, respectively, have been suppressed. Excellent progress has also been made within the barrier zone, especially in further reducing the sizable infestation discovered in Putnam Valley, Putnam County, in 1937. A small isolated infestation exists in Yonkers, Westchester County, but no evidence of the gypsy moth was located in the boroughs of the Bronx and Manhattan, and on Long Island only 7 infestations, totalling 47 egg clusters, were found and treated. Seven Federal high-power sprayers were used in the New York area.

Inspection and certification of nursery stock and forest and other products at time of shipment was discontinued in the Long Island area on May 31, 1939. The New York Department of Agriculture and Markets will inspect and certify all nursery properties within the previously regulated area at least once each year and safeguard shipment of stock.

Work in Pennsylvania was confined chiefly to the centrally infested area where the gypsy moth is most abundant. Intensive work was also done at sites of infestations discovered last year in outside territory and within a ½-mile radius of assembling cages at which adult male gypsy moths were taken during the summer of 1938. Spraying of the infested residential areas was begun on May 22, and woodland spraying started June 1. A total of 35 high-power sprayers were used on this work. Spraying was discontinued before the end of the work period in June because the supply of lead arsenate was exhausted.

The Pennsylvania State quarantine on account of the gypsy moth has been strictly enforced, and 16 shippers were prosecuted and con-

victed of violating the State quarantine law. Approximately 32,500 shipments originating within the generally infested area were thoroughly inspected and certified as free from this insect before movement was permitted, and about 42,000 shipments originating in the lightly infested area were moved under permit during the year.

GYPSY MOTH WORK BY CIVILIAN CONSERVATION CORPS

This Bureau has continued to supervise C. C. C. gypsy moth work in part of the area between the barrier zone and the Connecticut River in Vermont, Massachusetts, and Connecticut, and cooperation has been maintained with the various State, Federal, and C. C. C. officials.

After the hurricane of September 1938 the daily average of enrollees available for the work dropped from 499, which was approximately the same as at the end of the previous year, to 169. This amounted in man-days for the year to a reduction of 56 percent.

At the beginning of the year men were available from 11 camps (2 in Vermont, 4 in Massachusetts, and 5 in Connecticut), while at the close of the year they were furnished by only 4 camps (2 in Massachusetts and 2 in Connecticut). All work was discontinued in Vermont soon after the storm, and the reduction in Massachusetts was very severe, as 2 of the camps removed worked exclusively on gypsy moth control.

The drastic reduction in manpower made it impossible to approach the completion of the work plan. Scouting and burlapping were drastically cut, and the men were concentrated in areas of especially heavy infestation. Many areas that needed follow-up work were left untouched. If the work could have continued, as planned, further work in some areas could have been discontinued for several years.

The severest and most extensive defoliation that has ever occurred in the area between the barrier zone and the Connecticut River in Vermont, Massachusetts, and Connecticut developed in the summer of 1938. Work was planned in these and adjoining areas during the present year but could not be carried out because the force was reduced.

Some work was done in 38 towns (6 in Vermont, 12 in Massachusetts, and 20 in Connecticut), and some infestation was found in all with the exception of 2 in Connecticut. As much of these areas as possible was treated.

Approximately 62,000 6-hour C. C. C. man-days were used. Most of the work was done in very heavy infestation, so that slightly more than 25,000 acres were covered. About 1,650 acres of woodland were thinned, and approximately all the brush from this operation was burned. Over 8,800,000 new gypsy moth egg clusters were destroyed, about 1,600,000 of which were burned in brush piles. In addition, burlap bands were applied to over 52,000 trees, and more than 3,400,000 gypsy moth caterpillars and pupae were destroyed.

Intensive work was done on 515 acres in the main infestation of a large woodland block in the Granby-Simsbury-Canton section of Connecticut. On this acreage over 7,068,000 new gypsy moth egg clusters were destroyed by creosoting and burning. The work consisted of piling the forest debris and of chopping out much of the undergrowth, especially of the favored-food-plant species. This ma-

terial was burned, egg clusters that could be reached with an 18-foot pole were creosoted, and many trees were climbed to complete the operation. The infestation was so severe in this district that many broken egg clusters and those on fallen leaves could not be treated, and many caterpillars hatched in the spring. The treatment applied prevented a large number of colonies from being established by wind spread. In some parts of the 1,500-acre area trees were nearly defoliated before spray could be applied. Recent examination of the area shows a great reduction in the infestation, although some new egg clusters are present around the edges of the sprayed area and in adjoining woodlands.

The C. C. C. gypsy moth work has been very helpful, and areas are in good condition where work plans have not been interrupted. There has been very severe increase in defoliation in many areas where work could not be done. To make substantial progress more manpower with adequate supervision is needed in the territory where these camps are operating.

Table 6 gives a consolidated report of scouting and treating done by the Bureau during the year.

TABLE 6.—*Gypsy moth control work, fiscal year 1939*

State	Project	Scouting							Thinning		Fencing		Banding			Spraying		
		Open country scouted					Woodland scouted	Egg clusters creosoted	Woodland thinned	Trees cut in open	Erected	Removed	Burlap bands applied	Pupae crushed	Larvae crushed	Woodland sprayed	Residential properties sprayed	Trees in open sprayed
		Open areas scouted	Roads	Apple trees	Oak trees	Shade trees												
		Acres	*Miles*	*Number*	*Number*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Feet*	*Feet*	*Number*	*Number*	*Number*	*Acres*	*Number*	*Number*
Maine	Regular	3,455	18	1,775	170	28,460	143	10	0	0	0	0	125	0	0	0	34	1,225
Vermont	W. P. A. and regular	144,662	779	133,231	9,412	326,806	338,107	102	1	150	60,260	0	6,248	8	7	176	16	0
	C. C. C.	195	2	185	0	110	2,060	36,356	91	260	0	0	0	207,328	508,871	0	0	0
Massachusetts	W. P. A. and regular	55,417	663	77,349	6,072	78,329	120,183	8,984	494	167	412,751	392,196	78,634	687,191	7,839	1,464	49	515
	C. C. C.	2,722	42	6,105	3,718	6,439	12,580	1,180,960	1,073	1,901	0	0	50,945	461,249	2,218,850	0	0	0
Connecticut	W. P. A. and regular	83,290	802	81,531	53,274	247,421	101,791	6,813	131	0	94,330	31,360	272,248	1,995	4,462	2,351	2	325
	C. C. C.	1,975	22	6,793	621	2,941	4,277	[1] 7,642,053	490	146	[2] 14,187	0	2,033	2,157	6,413	1,524	5	0
New York	W. P. A.	24,151	226	43,810	29,745	181,662	61,132	20	198	0	1,320	27,000	[3] 66,011	1	1,822	1	35	1,700
	State and C. C. C.	248,018	2,214	600,743	0	4,760,487	170,525	821	1,359	0	0	0	[3] 201,258	0	2,125	1,389	0	0
Pennsylvania	W. P. A. and regular	24,230	265	64,562	23,333	251,576	60,714	186,402	110	5	88,907	178,244	404,654	43,189	40,002	7,353	3,586	39,262
Total	do. [4]	583,223	4,967	1,003,001	122,006	5,874,741	852,595	203,152	2,293	322	657,568	628,800	1,029,178	732,384	56,257	12,734	3,722	43,027
	C. C. C. [5]	4,892	66	13,083	4,339	9,490	18,917	8,859,369	1,654	2,307	14,187	0	52,978	670,734	2,734,134	1,524	5	0
Grand total		588,115	5,033	1,016,084	126,345	5,884,231	871,512	9,062,521	3,947	2,629	671,755	628,800	1,082,156	1,403,118	2,790,391	14,258	3,727	43,027

[1] 1,683,265 estimated number of egg clusters burned in piles of debris included in Connecticut figure.
[2] Wire strung by State crew.
[3] A large percentage of the bands applied in New York were of sticky material instead of burlap.
[4] Includes State and C. C. C. work in New York.
[5] Not including C. C. C. in New York.

GYPSY AND BROWN-TAIL MOTH QUARANTINE ENFORCEMENT

REGULATORY CHANGES

On the basis of 3 successive years of negative scouting, it was possible this year to reduce further the gypsy moth regulated areas in New Hampshire and Vermont. This release of territory extended to 22 towns in Vermont and 4 towns in New Hampshire. This revision was of importance to Christmas-tree operators, since balsam fir and spruce are cut and shipped in quantities from these towns. It also released from regulation the important marble- and granite-shipping districts centering around Rutland, Vt. In all, considerable certification work has been eliminated by freeing this territory.

Increased gypsy moth infestation in parts of Maine, on the other hand, necessitated shifting a sizable block of towns in that State from the status of lightly to generally infested territory. Sections of six Maine counties were involved in the change. In addition, similar changes in status were made in several towns in three counties in Vermont and a few towns in a single New Hampshire county. None of the towns newly assigned to the generally infested classification are important as centers for Christmas-tree cutting.

These changes in regulated area were accomplished under a revision of the gypsy moth quarantine and supplementary regulations effective September 29, 1938.

CERTIFICATION OF QUARANTINED PRODUCTS

Continued heavy infestation in scattered sections of the generally infested gypsy moth area resulted in a further increase in the number of egg masses and other stages of the insect removed in the course of inspection of quarantined products. During the year inspectors removed 2,010 egg clusters, 150 larvae, and 74 pupae from products inspected and certified before movement to noninfested area. Typical removals in the course of an inspector's daily rounds were 32 egg clusters, 1 larva, and 29 pupae taken from a carload of lumber loaded at Westcott, Maine, for shipment to Toledo, Ohio, and 75 egg clusters creosoted and removed from a carload of birch firewood inspected as it was loaded at Cornish, Maine, for transportation to Philadelphia, Pa. A larger number of egg masses were removed from evergreen products than from either forest products, stone and quarry products, or nursery stock inspected during the year.

Twenty-three egg clusters were removed from 23,494 consignments of nursery stock certified during the year. Nursery products inspected were as follows:

	Number
Shrubs	3,057,352
Specimen trees	21,521
Young trees	207,657
Specimen evergreens	215,563
Young evergreens	2,976,643
Seedlings, cuttings, and small plants	3,298,294
White pine trees	301

Joint certificates for most of this material were issued under both the Japanese beetle and the gypsy moth quarantine regulations.

Cutting of Christmas trees started in New England on October 15. Inspection of Christmas trees in the lightly infested gypsy moth area was considerably delayed owing to the warm weather prior to November 25. Twenty temporary inspectors were employed for the period of Christmas-tree and greenery inspection, which was completed on December 24. There was a 55-percent decrease in the number of Christmas trees offered for inspection and certification as compared with the number in 1937. Curtailment of cutting operations, due to warm weather early in the season, accounted for most of the decrease. This reduction is partly accounted for, also, by the fact that a large oversupply of trees in 1937 glutted the markets and made the buyers more conservative in their 1938 bookings. The situation is further explained by the removal from the lightly infested regulated area of 26 towns in New Hampshire and Vermont.

From 18,457 separate lots of evergreen products examined 1,164 egg clusters, 3 larvae, and 1 pupa were removed. The record removal in connection with the season's inspections of evergreen-bough material consisted of 500 egg clusters found on 5 tons of boughs inspected at Cape Porpoise, Maine. Products in this category certified during the year consisted of the following:

Boughs, balsam twigs, and mixed greens	boxes or bales	39,641
Christmas trees	number	344,066
Laurel	boxes or bales	7,126
Miscellaneous	do	6,262
Do	yards of roping	4,950
Do	truckloads	1

During the year 21,441 shipments of forest products were inspected and certified. From these, 821 egg masses, 82 larvae, and 73 pupae were removed. Individual items certified in these shipments were as follows:

Barrel parts, crates, crating	cases, bundles	59,727
Logs, piles, posts, poles, ship knees, and ties	pieces	1,038,717
Fuel wood	cords	1,902
Pulpwood	do	30,934
Miscellaneous wood	do	134
Lumber	board feet	40,380,770
Empty cable reels	number	42,417
Shavings	bales	29,581
Shrub and vine cuttings	boxes	808
Lags	bundles	7,999
Miscellaneous	pieces	286,453
Do	carloads	80
Do	bundles, bags, boxes	1,033
Do	carloads and truckloads	14

A practicable method of ridding wood edgings of gypsy moth infestation in the process of converting them into chips or shavings was successfully worked out in consultation with an engineering firm. Need for such a procedure was imperative to facilitate the certification of a large quantity of wood shavings being shipped to Brooklyn, N. Y., by a lumber company in the heavily infested area. By installation of a new type of cutter and blower, shavings came through free of all traces of egg masses or individual eggs.

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Stone and quarry products included in 20.264 lots examined during the year disclosed 2 egg clusters and 65 larvae. The contents of the shipments were as shown in the following list:

Crushed rock	tons	551
Curbing	running feet	34,873
Feldspar	tons	1,391
Granite	pieces	397,159
Do	tons	37,056
Monumental stone	pieces	19,512
Grout	tons	5,705
Marble	pieces	530
Limestone	tons	90
Paving blocks	number	600,913
Scrap iron	tons	184
Miscellaneous	pieces	4,379
Do	tons	324
Do	carloads	6

VIOLATIONS

Apparent violations of the gypsy and brown-tail moth quarantine totaled 1,122. Two prosecutions were terminated in convictions. One covered two consignments of spruce and hemlock cuttings from Winsted, Conn., to New York City without the required inspection and certification. The other case covered two consignments of birch logs from Worcester, Mass., shipped to Atlantic City, N. J., and Washington, D. C., respectively, without certification.

DUTCH ELM DISEASE ERADICATION

GENERAL STATUS

Several localized sections in New Jersey and Connecticut heavily infected with the Dutch elm disease accounted for a sizable increase in the comparative number of infected trees discovered during the year. Intensive elm-sanitation operations in these infection centers have destroyed the trees in which tremendous numbers of elm bark beetles, carriers of the disease, were hibernating. Elms infected with the disease were found in Pennsylvania for the first time in July 1938. Sporadic infections were discovered in additional towns in Dutchess County, N. Y., and in a number of towns in Orange and Ulster Counties, N. Y., outside the zone previously known to be infected.

Surveys in States remote from the main infected area failed to disclose a single new infection center. There was also no recurrence of the disease at Baltimore and Cumberland, Md., Norfolk and Portsmouth, Va., or Cincinnati and Cleveland, Ohio, where infected trees had been destroyed in previous years. Diseased trees found at outlying points were limited to 19 scattered cases in the Indianapolis, Ind., area, 4 cases in the Athens, Ohio, territory, and a single infection at Wiley Ford, W. Va.

Enforcement of the embargo on the movement of elm material from the infected territory listed in the regulations supplemental to Quarantine No. 71 continued during the year.

SYSTEMATIC SCOUTING

As revealed by the 1938 summer scouting, the principal spread of the disease was a short jump into Pennsylvania from the nearby in-

fected area in New Jersey, invasion of 2 tiers of townships in central New Jersey and southwestern Connecticut, and a more serious increase in the Dutchess County, N. Y., area. The Dutchess County infection is of particular importance because it brings the line of infection to within a few miles of the Massachusetts-New York State line. A total of 126 diseased elms were found in Dutchess County during the year.

Scouting during the 1938 foliage season, begun on June 13 in the previous fiscal year, continued until September 30, with a scouting force ranging from 1,682 to 2,445 men. During this period the infection of 15,909 elms with the fungus causing the disease was confirmed. These were divided as follows: Connecticut, 496; New Jersey, 14,216; New York, 1,157; Pennsylvania, 9; and outside States, 31. In comparison with confirmations during the 1937 scouting season, the cases in 1938 tripled in New Jersey and quadrupled in Connecticut, while fewer confirmations were found at the isolated infections. The number in New York was approximately the same both years.

From all sources 103,264 twig samples were submitted to the culture laboratory for identification. *Ceratostomella ulmi*, the fungus causing the disease, was cultured from 18,586 samples. Connecticut had 548 confirmations, New Jersey 16,752, New York 1,216, Pennsylvania 46, and outlying States 24. These totals represent increases of approximately 250 percent in both Connecticut and New Jersey combined, and reductions of 7 percent and 55 percent, respectively, in New York and outlying States, as compared with the previous year's confirmations. This year's confirmations added to the 6,500 cases reported last year and the 23,125 diseased trees found from 1930 to 1937 make a country-wide grand total of 48,211.

A severe concentration of infection was discovered during July near the border of the known infected zone in the Sourland Mountain section of Mercer, Hunterdon, and Somerset Counties, N. J. The wilt from the infection, plus the wilted, dangling twigs resulting from heavy crotch feeding by elm bark beetles, gave many of the trees the appearance of being infected with fire blight. All this section was intensively scouted during the rest of the foliage season. In Connecticut the northeastermost of the heavy, localized infections was found near Weston.

Scouting and sanitation activities in the infected sections in and surrounding Indianapolis, Ind., resulted in the location of only 19 infected trees as compared with 46 during the previous fiscal year. Other systematic scouting activities outside the regulated area were concentrated in the Athens, Ohio, area and the Cumberland, Md.–Wiley Ford, W. Va., area. Four disease cases were found at Athens, an increase over the number found the previous year. In Wiley Ford only 1 infected tree was found in the section where 5 had been located in the summer of 1937. Observations were also made to determine any reappearance of the disease at other isolated points at which infection had been discovered in previous years.

The infection of 161 trees in isolated infected areas has been verified. Of these, 104 are in Indianapolis, Ind.; 2 in Baltimore, 3 in Brunswick, and 1 in Cumberland, Md.; 6 in Athens, 1 in Cincinnati, and 33 in Cleveland, Ohio; 5 in Norfolk-Portsmouth, Va.; and 6 in Wiley Ford, W. Va.

There were two complete systematic surveys by scouts on foot in the older infected territory and in most of the newly infected sections that were added as the scouting progressed. Complete coverage in at least one survey and a partial second going over were made in the 10-mile protective zone. Surveys outside the infected zone were made by scouts on foot and scouts cruising in trucks and were supplemented by aerial observations in the remaining territory. Several special-problem areas in the Connecticut and New York infected zones were given a third going over.

Aerial mosaic maps of most of the sections of Connecticut, New Jersey, and New York in which scouting and eradicating were to be done were purchased for use during the 1938 scouting season. Use of these maps speeded up both the scouting and eradication work. By placing a dot on the exact tree affected and surrounding it with a circle, it was possible accurately to estimate distances from nearby landmarks by consulting grid lines photographed on the map at intervals of 4,000 feet. Eradication crews in turn were furnished with maps on which elms to be removed were spotted, and this enabled them to return to the exact spot by the nearest accessible road.

With the addition of another autogiro, five aerial scouting units were available for service in difficult scouting areas during the year. Activities of these units during the 1938 foliage season were largely a repetition of previous seasons' autogiro surveys but on an expanded scale. Single autogiro scouting units were assigned to the protective areas in Pennsylvania and New Jersey, and two of the ships and their accompanying ground crews worked in the more extensive protective zone in New York. The fifth aerial crew flew the railroad rights-of-way over which elm logs that introduced the fungus to this country travelled to midwestern veneer mills. Autogiro scouts were credited with the discovery of a number of the first-record infections in Dutchess County, N. Y.

On May 8 the culture laboratory at which the organisms infecting twig samples submitted by field workers are determined was transferred from Morristown, N. J., to the Bloomfield, N. J., field headquarters. Most of the necessary equipment was installed and in operation by that date.

In the spring of 1939 foliage wilt characteristic of Dutch elm disease infection was first observed in the field on May 16 on a small elm in Greenwich, Conn. In Dutchess County, N. Y., during the same week another instance of early-season wilt was reported. On May 26 characteristic wilting was observed on an elm near the Sourland Mountains, in Somerset County, N. J. Wilting was also observed late in June on an elm tree in Putnam County, N. Y.

Organization of a quota of 1,500 fully trained and capable scouts to be paid from regular Departmental funds made available in the Second Deficiency Appropriation Act began early in June. Approximately 2,300 men were notified to report for scout training on June 12. They were assigned largely to the infected areas, and their activities were in addition to the scouting work performed by the regular W. P. A. force.

EXTENSIONS OF WORK AREA

Additions to the infected zone as a result of the discovery of diseased elms in or just beyond the 10-mile protective zone surrounding the

known infected area included 41 townships, towns, and boroughs. These were as follows: In Connecticut, the towns of Bridgeport, Danbury, Easton, Newtown, and Stratford in Fairfield County, and the town of North Branford in New Haven County; in New Jersey, the township of Kingwood in Hunterdon County, and Ewing, Hamilton, and Lawrence in Mercer County; Howell, Marlboro, and Upper Freehold in Monmouth County; Stillwater in Sussex County; and Blairstown, Greenwich, Hardwick, and Knowlton Townships in Warren County; in New York, the towns of Clinton, LaGrange, Pawling, Pine Plains, Pleasant Valley, Stanford, Wappingers Falls, and Washington Hollow in Dutchess County; Greenville and Newburgh in Orange County; Patterson in Putnam County; and Esopus and Saugerties in Ulster County; and in Pennsylvania, the townships of Bridgeton, Buckingham, Falls, Lower Makefield, Solebury, Tinicum, Upper Makefield, and Wrightstown in Bucks County; and the township of Upper Mount Bethel and the borough of West Easton in Northampton County.

Expansion of the boundary of the infected zone to include all newly infected points added 1,730 square miles to the area, with a corresponding increase of 336 square miles in the 10-mile protective band. The major diseased area at the end of June comprised 493 square miles in Connecticut, 3,610 in New Jersey, 2,850 in New York, and 227 in Pennsylvania, a total of 7,180 square miles. The protective area included 758 square miles in Connecticut, 502 in New Jersey, 1,144 in New York, and 1,236 in Pennsylvania, totalling 3,640 square miles. The entire zone of field operations totaled 10,820 square miles, an area approximating in size the State of Vermont.

ERADICATION AND SANITATION ACTIVITIES

Activities of sanitation crews during the fall, winter, and spring consisted in removal of trees infected with elm bark beetles, individual dead and dying trees, and dead and dying trees, covered by a blanket permission for an entire section; intensive local sanitation in problem areas; clear cutting of elms in heavily infected areas; and destruction of elms in close proximity to trees confirmed as infected. Disposal of wood piles and the pruning of beetle wood were also activities of the sanitation crews. These operations had as their primary purpose the destruction of the fungus causing the disease and of material infected with the insect vectors of the fungus. Additional selective work comprised such activities as the creation of elm-free areas, through either clear cutting or other operations, to reduce costs and limit the extent of field activities.

Elms removed by the crews engaged in the various operations involved in eradication, sanitation, and selective work numbered 773,604. This reduction from last year's grand total of 1,206,000 trees removed was due to the fact that fewer W. P. A. workers were carried through the winter this year and that thorough sanitation activities were concentrated where they would be of the most benefit in either eradicating the disease or reducing the elm bark beetle population. The accumulative total of elms destroyed in the varied operations since the work was organized in 1931 is now 5,303,848.

Elm-sanitation work outside of the main zone of operations was centered at the three isolated infection centers in Indianapolis, Ind., Athens, Ohio, and Wiley Ford, W. Va. Several diseased trees were

discovered as elms were being removed in the vicinity of previous infections in the Indianapolis area. Initial clean-up work in Athens was completed in January. The sanitation area in the vicinity of Wiley Ford, W. Va., and Cumberland, Md., followed the Potomac River between Pinto and Spring Gap, Md.

One of the largest sanitation operations in the infected area was carried on in a large swamp in Patterson Township, Putnam County, N. Y. Over 10,000 elms of all sizes were removed from this 1,500-acre swamp. All elms within a 500-foot radius of an infected tree in the south end of the swamp were pruned.

Intensive elm-sanitation work was performed on all elm trees within a mile of the focal points of the disease in Dutchess County, N. Y.

Following the disastrous hurricane that swept over part of New England on September 21, sanitation crews in Connecticut were assigned to a rapid clean-up of the uprooted elms, trees with weakened branches and hanging branches, and elm debris that furnished ideal conditions for large increases in the insect carriers of the disease fungus. Most of this material was destroyed before the possibility of beetle emergence in May.

Tests were made to develop larvicidal material that may be used to destroy elm bark beetles infesting piles of elm logs that owners wish to keep under fuel agreements and will also serve as a repellent to these beetles when sprayed on freshly cut green logs that will upon drying become attractive to migrating beetles. Promising results were obtained with orthodichlorobenzene-naphthalene emulsion.

There were fewer fluctuations in the W. P. A. personnel throughout the year than previously. The number of workers ranged from 2,800 to 3,400 during the scouting season of 1938. From 2,900 to 3,300 men were retained in the eradication and sanitation activities until March. The first week in April the force was increased to approximately 3,650, and at this figure it was maintained for the rest of the year.

SOURCES OF FUNDS

Funds for operation of the eradication project were derived from a regular departmental appropriation of $378,489 and supplementary allotments made by the Works Progress Administration. The total was $2,957,500 for field work and $51,789 for administrative expenses. A further item of $100,000 was included in the Second Deficiency Appropriation Act of May 2, 1939, for the employment and training in mid-June of a large scouting organization.

Appropriations and allotments made by States engaged in cooperative eradication work amounted to $7,985 in Connecticut, $38,189 in New Jersey, $154,195 in New York, and $500 in Maryland. An estimated $5,000 from a State joint fund for Dutch elm disease, Japanese beetle, and European corn borer control was expended for Dutch elm disease work in Indiana. Two noninfected States, Massachusetts and Rhode Island, allotted $5,000 and $500, respectively, to Dutch elm disease research and surveys.

WHITE PINE BLISTER RUST CONTROL

RIBES ERADICATION IN 1938

The Bureau continued its program for the control of white pine blister rust in the United States in cooperation with State and local

agencies, the Forest Service and Soil Conservation Service of the Department of Agriculture, and the National Park Service and the Office of Indian Affairs of the Department of the Interior. The accomplishments summarized in this report include the results of the combined efforts of the Bureau and cooperating agencies.

During the calendar year 1938, 98,740,837 currant and gooseberry plants (*Ribes*) were destroyed on white pine forest areas in the United States totaling 2,234,849 acres. The treated acreage includes 1,547,426 acres on which only initial work was done and 687,423 that were reworked. The reworked acreage consisted of areas on which the *Ribes* were originally so numerous that it was necessary to go over them one or more times subsequently. This work is done at periodic intervals to maintain control conditions by destroying *Ribes* that have developed from seeds or sprouts and attained sufficient size to endanger the pines. Usually only portions of initially worked areas require two or more workings.

A large proportion of the *Ribes* eradication work has been carried on with relief labor. During the year this work provided 639,752 man-days of employment. The labor used by all cooperating agencies included 15,392 different individuals, of whom 6,892 were relief laborers, 6,657 C. C. C. enrollees, and 1,843 temporary employees of the Department and of cooperating State and local agencies. Where the work is in remote forest areas it is necessary to subsist the men in camps. Men from 298 camps were assigned to this work. Of these camps, 50 were relief-labor camps and 29 were occupied by temporary employees of the Department and cooperating agencies. Practically all these camps were on forest areas in the western white pine and sugar pine regions. In addition, C. C. C. enrollees in varying numbers were assigned to blister-rust control work from 219 camps, a large proportion of which were located in the Eastern States. The details of the *Ribes* eradication work are given in table 7.

TABLE 7.—*Ribes eradication work during the calendar year 1938*

Region	Initial eradication	Reeradication	Total initial eradication and reeradication [1]	Effective labor	*Ribes* destroyed
	Acres	*Acres*	*Acres*	*Man-days*	*Number*
Northeastern States	330,705	410,864	741,569	203,943	13,821,861
Southern Appalachian States	663,442	71,566	735,008	40,828	4,750,971
North Central States	405,518	70,295	475,813	79,563	18,700,421
Western white pine States (Idaho, Montana, Washington)	78,201	92,562	170,763	195,364	38,265,241
Sugar pine States (California and Oregon)	69,379	40,174	109,553	119,258	23,093,653
Rocky Mountain States (Colorado and Wyoming)	181	1,962	2,143	796	108,690
Total	1,547,426	687,423	2,234,849	639,752	98,740,837

[1] Includes work of cooperating Federal, State, and local agencies.

Of the acreage reported above, about two-thirds, or 1,530,703 acres, was worked by eradication crews paid from allotments of emergency-relief funds to the Bureau and to the Forest Service. The C. C. C. enrollees covered 487,542 acres, and the remaining 216,604 acres were worked by temporary employees of the Department and other cooperating agencies. Numerous States and townships provided appro-

priations for cooperation in control work on pinelands within their borders, the most substantial of such appropriations being those of New York and Idaho.

The work of the C. C. C. on the national forests was performed by enrollees from camps assigned to the Forest Service of this Department. The work on the national parks and Indian reservations was carried on by labor from C. C. C. camps allotted to the National Park Service and Office of Indian Affairs of the Department of the Interior. The C. C. C. work on private and State lands was performed in most cases by labor assigned from camps under the direction of State foresters and the Soil Conservation Service.

STATUS OF CONTROL WORK BY REGIONS

The beginning of large-scale control work and the rate of progress have varied in the different white pine regions. Prior to 1933 most attention was given to large-scale control operations in the Northeastern States, where the disease was most prevalent and was causing serious damage. In the other parts of the country, where the disease was either absent or progressing much more slowly, control work remained in the developmental stage.

Beginning in 1933, *Ribes* eradication in all white pine regions was stimulated and expanded through the use of emergency-relief funds. These funds became available at an opportune time, as the disease was reaching the damaging stage in all sections of the country except the sugar pine regions, and the need for increasing the scope of control activities was very presisng. Blister rust work not only afforded an opportunity for the use of a large amount of unemployed labor, but most of the funds were used for wages. These funds provided the control program in all regions with its first large supply of manpower. In addition, labor from C. C. C. camps was used wherever available within working distance of white pine stands needing protection. The status of control work at the end of 1938 is shown in table 8.

TABLE 8.—*Status of blister rust control work by regions on December 31, 1938*

Region	Control areas initially protected [1]	Control areas reworked subsequent to initial protection	*Ribes* destroyed	Effective labor
	Acres	*Acres*	*Number*	*Man-days*
Northeastern States	10,141,962	3,383,592	248,501,955	2,322,469
Southern Appalachian States	4,855,221	767,044	22,591,102	195,448
North Central States	2,484,512	197,694	186,806,819	713,965
Western white pine States (Idaho, Montana, Washington)	1,790,604	206,843	367,050,892	1,562,746
Sugar pine States (California and Oregon)	651,710	119,239	104,063,802	415,677
Rocky Mountain States [2] (Colorado and Wyoming)	36,619	1,962	1,583,306	13,896
Total	19,960,628	4,676,374	930,597,876	5,224,201

[1] The figures shown are net totals to Dec. 31, 1938, and do not include worked areas that were later removed from control-area status owing to their reversion to nonpine-producing types as a result of fire, cutting, or other causes. They are thus not strictly comparable with table 7 of the Bureau report for the fiscal year 1938.

[2] The work in Colorado and Wyoming represents experimental *Ribes* eradication in stands of limber, whitebark, and bristlecone pines on national forests to develop practical control measures for the Rocky Mountain region in advance of the spread of the rust. The acreages shown for these 2 States are not at present considered as part of the commercial white pine areas of the United States.

SPREAD OF BLISTER RUST IN 1938

Information on the spread of the disease is used in planning control work. *Ribes* eradication is carried out around local pine stands of sufficient value to justify the expense of protection, and such protection is effective regardless of the amount of disease in the vicinity. Blister rust control work, accordingly, is not primarily directed at retarding the spread of infection to new localities but is carried out, where practicable, to prevent injury to valuable pine stands before the disease arrives in a locality, as well as after it has become established in forest areas.

During the calendar year 1938 blister rust was found for the first time on either white pine or *Ribes* in 70 counties. Six of these counties are in the southern Appalachian States, 60 in the North Central States, 2 in Montana, and 2 in California.

In the southern Appalachian States the rust was found on white pine in Highland County, Va., and on *Ribes* in four counties in Virginia and one in West Virginia. These discoveries did not extend the spread of the disease farther south but added new counties within the previously known limits of infection in the southern Appalachian region.

The most extensive spread into new territory occurred in the North Central States, where weather conditions appeared to be more favorable for the dissemination of the rust. Infection was found for the first time on white pine in 8 counties in Ohio, Michigan, and Wisconsin and on *Ribes* in 55 counties in Ohio, Michigan, Wisconsin, Minnesota, Indiana, Illinois, and Iowa. In 38 of the 55 counties infection occurred on the cultivated black currant (*Ribes nigrum*). The large number of counties in which the disease was found on cultivated black currants indicates the importance of this species as a disseminator of the rust and the need for the eradication of these plants in regions where white pines are valuable forest and ornamental trees. The southern limits of the known infected area have been extended during the year from 1 to 3 counties in Ohio, Indiana, Illinois, and Iowa. In addition, many newly infected counties were added within the previously known limits of spread.

In Montana the disease was found widely distributed on wild *Ribes* on both sides of the Continental Divide. Infection was found at five different points where inspections were made in Glacier National Park. This represents an eastward extension of the rust into Flathead and Glacier Counties. Glacier National Park is situated within these counties.

During 1938 rust infection was found on *Ribes* in California 35 miles farther south than before and is now present about 160 miles below the Oregon-California border. Numerous other infections on *Ribes* were found within the sugar pine area previously reported as infected No rust was found on sugar pine south of the vicinity of the Oregon-California border, but since it takes from 3 to 4 years after infection for the resulting cankers to become easily discernible on pines, sufficient time has not elapsed since discovery of the disease in the State to enable the field men to find it readily on sugar pine. However, it is very probable that scattered pine infections exist in several sections of northern California.

One of the most significant finds on *Ribes* occurred in Shasta County, about 80 miles south of the Oregon line. In 1937 scouting activities in this locality uncovered only two diseased *Ribes*, each with but one leaf infected. A year later 300 infected *Ribes*, 50 of them *R. nevadense*, and the remainder *R. roezli*, were found to be heavily infected with blister rust in the same locality.

Again in Tehama County, west of Mount Lassen, 1937 scouting showed no infection, while in 1938 over 100 infected *Ribes roezli*, *R. inerme*, and *R. nevadense* bushes were found in a small localized area. Such discoveries, both in good association with sugar pine, have laid the foundation for centers of local infection on pines within the next few years.

WHITE PINE NURSERY STOCK PRODUCED FREE FROM BLISTER RUST INFECTION

Ribes eradication was carried on in the environs of 103 nurseries during 1938. These nurseries contained over 80,000,000 young white pines that were being grown for use in reforestation work. For several years nurseries producing white pine for forest planting have been examined annually to keep their environs free of *Ribes* by destroying any that may have developed from seeds or sprouts and thus assure the production of trees free from blister rust infection. This is important, as these trees are distributed widely for planting purposes and, if infected, would serve as carriers and spreaders of the disease. Most of the control areas around these nurseries have received from one to several workings, and although their protective borders are free of large bushes, in some cases seedlings and small bushes continue to make their appearance on portions of the protected areas.

During 1938 a total of 111,268 *Ribes* were destroyed on 45,346 acres in protection work around nurseries, or an average of about 2.4 bushes per acre. Many of these were seedling plants. Already the environs of some nurseries are so free of *Ribes* that they require only periodic inspections. The young trees are further safeguarded by arranging with planting agencies to have the reforestation sites examined for *Ribes* and such plants destroyed before the areas are planted with white pines. This assures protection to the new forest during the early years of its life. Young growth that remains unprotected is often completely destroyed by blister rust.

ERADICATION OF THE CULTIVATED BLACK CURRANT

An important phase of the Department's program for the control of blister rust consists in the eradication of the cultivated black currant (*Ribes nigrum*) in regions producing valuable crops of white pine timber. These currants are being eliminated because of their extreme susceptibility to infection and their importance in distributing the rust. Field observations show that they have been responsible for starting new centers of infection and firmly establishing the disease over extensive areas that otherwise might have remained free of the rust for many years. With few exceptions these plants are confined to gardens, from which they rarely escape. Hence they have not become established in our forests.

Owners of *R. nigrum* plants have given excellent cooperation in this work. Up to the present time 529,043 cultivated black currant bushes have been removed in the white pine regions of the United States. Half of these plants were found in the North Central States, 30 percent in the western white and sugar pine regions, 19 percent in the northeastern region, and less than 1 percent in the southern Appalachian States. During 1938, 15,935 cultivated black currant plants were eradicated, nearly all of which were located in the North Central States. The eradication of *R. nigrum* has retarded the natural spread of the disease both within and between white pine regions. This work is now nearing completion; although some of these plants probably will be found annually for several years, their influence in spreading the rust will soon have been reduced to a minimum.

TREATMENT OF INFECTED PINES OF HIGH VALUE

White pines have a wide use for recreational, ornamental, and esthetic purposes, and many such trees in public parks and around homes were attacked by blister rust before the disease-spreading currant and gooseberry bushes were removed. Methods have been developed for saving these infected pines by cutting out the diseased portions and preventing their reinfection by destroying any *Ribes* that may be present within 900 feet of the trees. The removal of the diseased parts of infected trees at Federal expense is restricted to ornamental and planted pines of high value in publicly owned pine stands and is not recommended as a control practice in native forest areas.

The treatment of infected pines was carried on during 1938 to a limited extent in the northern white pine regions of the Eastern States. In this work 92,358 white pines were saved by the removal of 171,731 cankers. In addition, 28,737 trees were destroyed because they were so thoroughly infected with blister rust that death was inevitable. This work involved the examination of 727,346 white pines and provided 5,478 man-days of employment.

WHITE PINE STANDS MAPPED FOR BLISTER RUST PROTECTION

White pines grow not only in pure stands but more often in mixture with other native species, usually of inferior value. In addition to forest stands there are numerous white pine wood lots, shelterbelts, plantations, recreational areas, and watershed-protection stands. Varying degrees of importance and value are placed upon these different white pine stands as encountered in the field, and good judgment is required in selecting those that justify blister rust protection. Commercial forest stands are selected for protection on the basis of their ultimate crop-production capacity at rotation age, and in determining this, consideration is given to forest and disease-control factors affecting the future of the crop. White pine shelterbelts, watersheds, and esthetic and recreational stands are considered on the basis of their value and practical utility for protective, recreational, scenic, and educational purposes.

During 1938 white pine stands and their protective borders totaling 2,785,235 acres were mapped for protection from blister rust. This

work provided 50,495 man-days of employment. The maps are used in carrying on *Ribes* eradication and greatly increase the efficiency of control work.

IMPROVEMENT OF CONTROL PRACTICES

Prior to 1938 the primary objective of the work in developing methods for blister rust control for the western white pine region was the chemical eradication of *Ribes*. Now, the chief interest is in the possibility of aiding *Ribes* suppression through forest-management practices. This shift parallels the transition gradually taking place in the control work for the western white pine region which calls for increased attention to rework problems. The most urgently needed data seem to be those related to the regeneration of *Ribes* on areas where these plants were removed by mechanical or chemical means. Observations, therefore, are being made in cooperation with the Forest Service on the effect of different methods of stand improvement on the regeneration of *Ribes*. The germination of *Ribes* seed and the growth rate of established plants are being given attention as foundations for interpreting records of large-scale eradication and checking work.

In the sugar pine region preliminary tests of a horse-drawn *Ribes* grapple for eradicating *Ribes roezli* are encouraging. Also a bulldozer was planned and tested for working heavy concentrations of mature upland *R. roezli*. These tools gave sufficient promise to justify further developmental work. Data further indicate that dynamite will be cheaper than chemicals for certain large *Ribes* in nonrocky sites. Where bushes are rooted among large boulders or in rock crevices, the use of oil or dry chemical is a more practical and economical method.

CEREAL AND FORAGE INSECT INVESTIGATIONS

WHITE-FRINGED BEETLE

Studies of the white-fringed beetle (*Pantomorus leucoloma* (Boh.)) in 1938 rendered certain the fact that this insect normally produces but one generation annually. Physical development and rate of reproduction of this insect are governed importantly by the kind of plant food it obtains. Among the cultivated crops peanuts are found to be the most favored food plant. The average number of eggs laid by this insect when feeding on peanuts was 1,531, but the maximum number laid by any one beetle was 2,418. This will illustrate the extreme power of reproduction possessed by this pest.

The fallowing of large areas of farm land as a control measure resulted in preventing oviposition of the beetle and caused a great reduction in larval population subsequently. Experiments in the rotation of crops indicated that much heavier populations of the beetle followed peanuts, and corn intercropped with velvetbeans, respectively, than was the case with pure stands of corn or cotton. In the field adults were found to feed on 132 species of plants and the larvae or grubs on 175 species.

GRASSHOPPERS

Observations of grasshopper populations on eighteen intensive long-period study areas which are being conducted by the Bureau

indicated consistently that there has occurred a gradual decline in adult grasshopper populations in practically all the areas under observation during the period 1936–38. This decline, however, has not been reflected in general grasshopper conditions throughout the Great Plains States. The intensive studies have also shown that the greatest grasshopper populations were recorded during the years of minimum rainfall and that when precipitation reached normal amounts populations declined to a point where slight damage was to be expected. It was also demonstrated that general damage from grasshopper attack does not become apparent until there are present five or more hoppers per square yard.

A publication containing the applicable results of recent investigations of grasshopper control, Farmers' Bulletin 1828, was issued in June. It contains much new material on grasshopper control, including four optional formulas for the preparation of bait having as bases mill-run bran, mixed feed, or shorts; standard wheat bran; low-grade flour; or sawdust with molasses. Liquid sodium arsenite was the poisoning agent.

In extensive experiments with substitutes for wheat bran or sawdust in grasshopper baits, cottonseed hulls, citrus meal, and chopped alfalfa have given promising results. Chopped-alfalfa baits showed a tendency to form lumps and therefore cannot be recommended for general use until some way is found to overcome this tendency. The large-scale use of bran and sawdust substitutes also depends on their cost and availability in large quantities as compared with bran and sawdust.

The late summer of 1938 was marked by unprecedented flights of lesser migratory grasshoppers from western South Dakota into western North Dakota and eastern Montana, where they laid enormous numbers of eggs. In June 1939, contrary to all previous experience, it developed that most of these grasshoppers had deposited their eggs not only on cultivated and recently reverted lands but also on open range lands where countless millions of young hoppers appeared. Only the most rapid and vigorous action on the part of those in charge of grasshopper control, by the enlistment of a fleet of airplanes to distribute grasshopper bait, prevented a major disaster to crops. It was feared that great flights of hoppers would originate on these heavily infested areas to reinfest neighboring areas which had already been freed from hoppers by the distribution of poisoned bait. Fortunately, however, such flights as did occur were mostly to the northwestward, and no great damage to crops occurred from this source.

THE MORMON CRICKET

The standard method of control for Mormon crickets for many years has been to dust them with a mixture of sodium arsenite and lime or diatomaceous earth. This method is effective but laborious and, owing to the arsenical content of the dust and the class of labor necessarily employed in distributing it, involves considerable danger to livestock where carelessness in distribution occurs. Because of these defects, since 1935 efforts have been made to develop a poisoned bait that would be efficient for Mormon cricket control. Such a bait containing sodium fluosilicate as the poisoning agent was developed in 1938, but opportunity for testing it on a large scale did not occur

until the spring of 1939, when extensive field tests of this bait were conducted in Washington, Nevada, Wyoming, and South Dakota. These field applications resulted in the destruction of from 78 to 98 percent of the crickets. They demonstrated conclusively the effectiveness of this bait when distributed at a rate not exceeding 12 pounds to the acre. It is believed that the general adoption of this means of control will result in a reduction in operating expense and an increase in safety to livestock within the affected area.

INSECTS ATTACKING CORN

In 1938 a distinct general trend was observed toward increased populations of the European corn borer in a region extending from the Great Lakes eastward to Massachusetts and central Connecticut. Of particular significance in the Great Lakes area was the occurrence near Toledo, Ohio, of infestations averaging 17 borers per plant in early market sweet corn. This crop was severely injured in Lucas, Erie, and Huron Counties. Infestation rose rapidly in central New Jersey, particularly in Monmouth, Mercer, and Middlesex Counties, in parts of which occurred the highest infestations in field corn that had as yet been recorded in this country. A maximum infestation of 25 borers per plant was observed in 4 percent of the fields examined, 10 borers per plant in 21 percent, and 5 borers per plant in 57 percent.

In the breeding of strains of sweet corn resistant to the corn borer 398 inbred strains were tested at Toledo. Of these, 77 Golden Bantam, 12 Country Gentleman, and 4 Stowell Evergreen lines showed apparent resistance and were selected for further testing. Among the Bantam inbred strains tested in 1938 were 25 inbred selections of sweet corn segregates of a cross of inbred lines 39D and a field corn inbred line R4. Only 1 of these lines was found to be significantly below average in performance, and 2 were significantly above average.

In breeding field corn 32 of the 235 strains tested in top-cross combinations in 1938 were found to be resistant to the borer. Fifteen of these were tested both for first- and second-generation exposure. Of these, 13 carried their resistance through both generations, and only 2 of them showed a slight degree of susceptibility to attack by the second generation.

The artificial distribution of the natural enemies of the European corn borer has progressed steadily, and surveys made to determine the status of these parasites in 1938 in northwestern Ohio indicated that there has been a progressive increase in parasitization each year from 1932 to 1938, inclusive, of from 0.2 percent in 1932 to 20.9 percent during the past year.

An announcement was made in last year's report of the discovery of two practical methods of protecting ears of sweet corn from attacks by the corn earworm. These methods are effective particularly for early market sweet corn and home-garden purposes. One of them is the fumigation of the ear tip by inserting a small tablet of the chemical hexachloroethane and subsequently applying a simple wire clip to prevent the gas from escaping after application. The other consists in the injection of a very small quantity of light mineral oil into the ear. These new methods are fully described and illustrated in two publications issued by this Bureau, namely, The Use of Oil for

Earworm Control in Sweet Corn, E–476, issued in May, and Control of Earworms in Corn by Fumigation, E–485, issued in July 1939.

Although these methods are fully effective in their present state of development only for such ears as possess fairly long, tight husks, it is believed that improvements now under way will result in the near future in rendering these methods applicable to ears of average character.

INSECTS ATTACKING FORAGE CROPS

An insect pest of the sweetclovers and possibly also of alfalfa, *Hypera brunneipennis* Boh., new to the United States, was discovered at Yuma, Ariz., in April 1939 by entomological workers of the Arizona Agricultural Experiment Station. This insect, native to northern Africa, is very closely related to the alfalfa weevil now generally distributed throughout the Great Basin States, but apparently the new weevil is adapted to a subtropical environment. On the approach of the hot summer season it entered a state of estivation.

A survey to determine the distribution of the insect was immediately conducted, which revealed that the species was present in alfalfa, both in Arizona and in California, in the immediate environment of the Yuma irrigated section. An entomologist was detailed to study the biology of this new pest.

Preliminary observations indicate that this insect prefers the sweetclovers and fenugreek to alfalfa.

As the Yuma Valley is a commercial alfalfa-seed-producing area, an early requirement in connection with this infestation was the determination of the liability of dispersion of this pest through shipments of alfalfa hay and seed sent out of the infested area. It was found that, because of the small size of the alfalfa seed in comparison with the size of the adult insect, all the adults which passed into the threshing machine were killed. The indications are that very little danger is involved in such shipments. Methods of fumigating alfalfa hay for safe shipment are being developed.

In August 1938 a commercial seed analyst in Oregon discovered, in vetch seed originating in Clackamas County, live specimens of the vetch weevil (*Bruchus brachialis* Fahr.), an insect of foreign origin previously known in this country only from the Atlantic Coast States. This bruchid, a serious pest of vetch seed, lays its eggs on the young pods, and the resulting grubs enter the growing pods and destroy the developing seed. As the Willamette Valley of Oregon is the most important vetch-seed-producing area in the United States, the infestation of this area at once aroused great interest, but as the adult bruchid emerges from the seed late in July and early in August and immediately seeks hibernating quarters, which are as yet unknown, the delimitation of the area infested by the insect was necessarily deferred until the summer of 1939. A survey recently completed shows that this pest now is present in eight counties in Oregon, including practically all the Willamette Valley, and four counties in southern Washington.

Preliminary studies of the vetch weevil already conducted, mainly in North Carolina, indicate that, although this insect attacks several of the commercially important varieties of vetch, other varieties are either entirely immune or strongly resistant to its attack. Although this insect does not injure vetch for hay purposes, if it should prove

as injurious in the Pacific Northwest as in North Carolina, it may become necessary to discontinue the culture of susceptible varieties and substitute therefor such varieties as are immune to the attacks of the insect. Methods of fumigating seed for safe shipment are being studied.

INSECTS ATTACKING SMALL GRAINS

For several years the work of breeding wheats resistant to attack by the hessian fly has been progressing steadily. In 1938 the fly-resistant characteristics of Dawson wheat had been successfully transmitted, through the fourth back crosses, to Poso and Big Club for the production of commercially desirable fly-resistant wheat for use under California conditions. It is now believed that this work may be completed in 1944.

Similar work in the production of fly-resistant wheats for culture in the soft red wheat areas has progressed well. In an experimental nursery at La Fayette, Ind., containing 100,000 consistently resistant segregates, the resistant lines as a whole retained a greater plant vigor and more definite tendency to tiller than was the case with lines susceptible to fly attack. Other experiments indicated that fly-infested wheat plants are more susceptible to winter-killing than uninfested plants.

INSECTS ATTACKING SUGARCANE

It is estimated that the sugarcane borer, which is one of the principal limiting factors in the production of cane sugar in Louisiana, caused losses amounting to $4,700,000 in 1938. According to recent experimental work in the control of this insect by sprays containing cryolite, both the natural and synthetic forms of this chemical give approximately 90-percent control.

INSECTS AFFECTING STORED GRAINS

A study of the condition of farm-stored grains in relation to insect infestation thereof, made in 1938, resulted in the publication in October of that year of Farmers' Bulletin 1811, Control of Insects Attacking Grain in Farm Storage. It contains directions for the simple fumigation of such grains under farm conditions, together with directions for the proper farm storage of such grains. A survey was made of ripening grains in various parts of Kansas, Missouri, Oklahoma, and Texas to determine to what extent these grains became infested by insect pests of stored grain prior to harvest. As a result, 21 different species of insects were reared from wheat heads gathered in the States mentioned. In southwestern Missouri the rice weevil was found infesting corn in 50 percent of the cornfields examined, but in Kansas only a few widely scattered fields were found to be infested. Surveys indicated that losses in farm-stored grain would be much heavier in 1938 than for some years previous.

The somewhat general use of chloropicrin gas for the fumigation of grain in storage had raised the question of the possible unfavorable effect of such fumigation on the germination of wheat. A recent investigation of this subject has shown that the viability of wheat containing 14 to 16 percent of moisture is seriously injured when exposed to a dosage of 6 pounds of chloropicrin to 1,000 bushels of

grain for a period of 6 hours at a temperature of 95° F. However, at a temperature of 50° F. wheats containing any normal degree of moisture can safely be fumigated with chloropicrin at dosages of from 1 to 6 pounds to 1,000 bushels of grain for periods not exceeding 12 hours.

Observations during the year have shown methyl bromide to have considerable promise as a cheap and efficient fumigant for flour mills and stored rice. A recent fumigation of a large warehouse containing 3,500,000 pounds of rice with methyl bromide at a dosage of 4.85 pounds to 1,000 pounds of rice gave a complete kill of the contained insect pests within a period of 42 hours at a temperature of 87° F.

WHITE-FRINGED BEETLE CONTROL AND ERADICATION

Observations on the results of control and eradication measures applied against the white-fringed beetle (*Pantomorus leucoloma* (Boh.)) and a closely related species, *P. peregrinus* (Buch.), indicate the effectiveness, as a means of reduction in beetle population, of calcium arsenate dust on host plants, of an oil-base emulsion as an herbicide to eliminate host vegetation along railroad rights-of-way, roadsides, abandoned fields, and waste areas, and of clean-cultivation practices in crop areas.

Such practices, which were an important part of the 1938 program, were continued and their application was extended so that one or a combination of such methods of control was used on all known infested properties. While there has not been sufficient time to fully determine the effectiveness of such types of control, field observations indicate drastic reduction in beetle population, though to a somewhat lesser degree in fields where legumes were planted and where cryolite was substituted for calcium arsenate, because of the detrimental effect of the latter insecticide on such plants. During the latter part of the year excessive precipitation made the application of control measures difficult.

One of the important phases of the program designed to prevent the spread of the pest was the enactment of a Federal domestic plant quarantine effective January 1, 1939. The regulations were strictly enforced. This quarantine is supplemented by State quarantine measures which place restrictions on intrastate movement of host materials. Intensive surveys were conducted to delimit known infested areas and to determine whether the pest had spread to other parts of the infested States and to other Southern States. No infestations were found in any State in which the beetle had not been previously known to exist. During the year infestations were found in the following areas:

Alabama: Covington, Geneva, Monroe, Conecuh, Mobile, and Wilcox Counties.
Florida: Okaloosa, Walton, and Escambia Counties.
Louisiana: St. Bernard, Orleans, Jefferson, East Baton Rouge, Plaquemines, and Jeff Davis Parishes.
Mississippi: Jones, Harrison, Stone, Smith, Covington, Jackson, Hinds, Pearl River, and Forrest Counties.

The total infested areas comprise approximately 50,000 acres, a large portion of which is idle, forest, waste, or abandoned land.

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Full cooperation was given by the affected States in applying measures designed to control, eradicate, and prevent the spread of the white-fringed beetle. Local W. P. A. projects assisted materially in control operations.

MORMON CRICKET CONTROL

In cooperation with the States of Colorado, Idaho, Montana, Nebraska, Nevada, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming, Mormon cricket control has been carried on with funds allotted to the Bureau from appropriations granted to the Department for the control of emergency outbreaks of insect pests and plant diseases. In addition to funds and personnel furnished by the States, substantial assistance was rendered by other Federal agencies and by many counties and communities in the infested States.

During the summer and early fall adult and egg surveys were conducted in the affected area to determine the intensity and extent of infestation as a basis for estimating probable control needs during the following crop season. More than 18 million acres were found to be infested, almost one-third of which were moderately or heavily infested, a considerable area being in the vicinity of valuable crops.

A cooperative plan of operations was developed under which participating States agreed to furnish technical assistance, transportation and living quarters for laborers, local hauling, storage, mixing plants, new dusting equipment and repairs, barrier metal, and motive power for dusters. The Bureau agreed to maintain field headquarters for the project, a project leader, supervision and administration, an adequate supervisory staff to plan, supervise, and direct control operations, and to provide oil, dust materials, power-duster operators, and warehouse facilities. Subsequent to agreement on these general principles, counties and communities were consulted and cooperative programs worked out with them. Various Federal agencies, including the Indian Service, the Forest Service, the Soil Conservation Service, and the Civilian Conservation Corps, cooperated in the program.

The plan of operations was based fundamentally on crop protection with latitude to permit work on areas distant from crops when danger of migrations from such areas to crop lands seemed likely, and also for work on areas where eradication appeared to be possible.

Crickets first appeared about mid-March, and early in April control work was well under way. Late in May and through June, operations were in full sway, with a peak of labor employment of more than 850 by the middle of June.

Sodium arsenite dust was most effectively used on the crickets by power, hand, and airplane dusters. Metal barrier, with pit traps, prevented crickets from entering crops, and an oil-on-water barrier was employed to kill the pests when they attempted to cross streams or ditches. Extensive field tests were conducted with a bait similar to that used for grasshoppers but consisting of sawdust, bran, and sodium fluosilicate. This material offers good promise, particularly where crickets and grasshoppers occur together, where crickets are

sparse and dusting control is impractical, or even in areas of heavy population.

At the end of the year more than 230,000 acres had been dusted with over 1,100,000 pounds of dust; more than 10,000 acres had been baited; metal barrier had been set up for more than 300 miles; and over 75,000 gallons of oil had been used on 425 miles of streams and ditches.

GRASSHOPPER CONTROL

Grasshopper control has been carried on under Federal funds appropriated for the control of incipient and emergency outbreaks of insect pests and plant diseases in cooperation with 24 Western States and with the aid of other Federal agencies, including the Civilian Conservation Corps, the Soil Conservation Service, the Forest Service, the Indian Service, the Agriculture Adjustment Administration, the Biological Survey, and the Federal Crop Insurance Corporation.

During the early part of the year control operations for the 1938 crop season were concluded. The infestation had been heavy and widespread, affecting all States but one west of the Mississippi River, as well as Illinois, Michigan, and Wisconsin. The success of the campaign was indicated by estimates, compiled by the States, of crop savings in excess of $176,000,000, or $79 worth of crops saved for each dollar spent on control.

During the late summer and early fall of the 1938 crop season an adult grasshopper and egg survey was conducted to determine the probable extent and degree of infestation to be expected during the subsequent season. Extensive, heavy concentrations of eggs were found in large areas in the Great Plains and Rocky Mountain States, extending from Texas to Minnesota, inclusive, and less extensive areas in other Western States. From this information estimates were made of the probable quantities of bait materials needed for control in the following spring and summer.

The surveys revealed heavy concentrations of eggs of two migratory species of grasshoppers in the northern and southern Great Plains States. In the Dakotas, Montana, and Wyoming eggs of the lesser migratory grasshopper were found over broad areas of sparsely populated idle and abandoned land in sufficient numbers to develop a serious outbreak unless natural control interfered. In southeastern Colorado, northeastern New Mexico, the panhandles of Texas and Oklahoma, and in a few counties in southwestern Kansas eggs of the long-winged migratory grasshopper (*Dissosteira longipennis* (Thos.)) were observed in heavy concentration on range land. Widely distributed over the Great Plains and intermingled with the migratory species, relatively heavy concentrations of eggs of nonmigratory species were found.

The threatening outbreak of migratory species necessitated an expansion of the control program to provide for direct participation, by the Bureau and the States, in mixing and applying bait in sparsely settled areas where heavy egg concentrations were found on idle, abandoned, and range land. In areas where eggs of nonmigratory species were dominant or where migratory species were less prevalent, the former policy of purchasing, transporting, and delivering bait materials to county mixing stations for spreading by farmers for pro-

tection of their own crops, under supervision of Federal and State supervisors, was considered adequate.

With a carry-over of more than 50,000 tons of bait materials, supplemented by late-winter purchases and the construction of thousands of additional mechanical spreaders, including more than 1,000 Federal machines, the cooperating agencies were prepared for the unusually early and uniform hatch of grasshoppers. As the season advanced, the outbreak predictions based on the egg survey were substantiated as conservatively accurate.

With adequate bait on hand at mixing stations to meet farmer demands for crop protection, the cooperating agencies swung rapidly into action on idle, abandoned, and range land. Farmer and community cooperation continued at a high peak until harvest diverted their attention.

In the area of the long-winged migratory grasshopper it became evident as the season advanced that excellent control was being obtained, and shortly after the close of the fiscal year operations were curtailed because of reduction in populations to not more than two or three grasshoppers per square yard. Plans were made to bait egg-bed concentrations later.

In the area of the lesser migratory grasshopper, enormous quantities of bait materials were distributed, particularly in Montana and North Dakota. Although at the height of the season it appeared that destructive migrations might develop from the enormous acreage of high populations, there were no mass, long-distance, destructive flights such as occurred in 1938, and while severe crop damage occurred in limited areas, it did not compare with the vast acreage of good crops protected.

At the close of the fiscal year more than 235,000 tons of bait had been made available to the States. To the following States the approximate amounts indicated had been shipped: North Dakota, 47,000 tons; Montana, 35,000; Minnesota, 25,000; Colorado, 25,000; South Dakota, 21,000. Other States received lesser amounts as needed.

During the season tests were conducted to determine the practicability of spreading bait from airplanes. Thirteen planes were leased and tested in areas of heavy populations, and present indications are that, while further work is needed on bait hoppers and spreading mechanisms, spreading of bait for grasshoppers by planes is a valuable adjunct to the control program, especially in idle lands and areas difficult of access by ground crews.

While it is yet too early to predict the amount of crop savings attributable to grasshopper control for the year, there is conclusive evidence that economic protection to crops has been given in spite of the unprecedented outbreak.

EUROPEAN CORN BORER INSPECTION AND CERTIFICATION

In the European corn borer certification work there was a considerable spurt in inspection activities to comply with the State quarantines of Arizona, California, Colorado, Georgia, Louisiana, Nevada, Oregon, Texas, and Utah. Inspection services were available through the gypsy moth and Japanese beetle inspection corps,

as well as through the corn borer inspectors in Detroit and Indianapolis.

A total of 50,190 certificates were issued to cover quarantined plant material valued at $157,000. This represented a 134-percent increase in the number of certificates over the preceding fiscal year but a 21-percent decrease in the value of the certified products. The increase in certifications was due to larger shipments of dahlias, gladioli, and chrysanthemums from Virginia, Maryland, New York, and Ohio.

BARBERRY ERADICATION

State, county, and local agencies in 17 grain-growing States continued active participation in the barberry-eradication program for the control of stem rust of cereals during the year. Stem rust is one of the most destructive diseases that attack grain crops, and control measures are applied uniformly on a regional rather than a State basis. Wherever barberry bushes susceptible to attack by the rust fungus are permitted to grow in or adjacent to important grain-growing areas they serve as early sources of inoculum that may cause local epidemics of the disease. In areas where bushes are numerous these local outbreaks often coalesce to form destructive regional epidemics before crops mature.

The annual rust survey was further systematized and extended to include observations in Mexico. The intensive search for barberry bushes, conducted with relief labor closely supervised by experienced Bureau personnel, was continued in counties that had not already been covered. Marked improvements were made both in survey and chemical-eradication procedures. Field demonstrations were held to instruct grain growers in the nature of the disease, the identification of barberry bushes, and recommended control practices.

BARBERRY BUSHES DESTROYED IN 221 COUNTIES

Barberry bushes were eradicated in 221 counties in the 17 participating States. With the aid of relief labor an intensive survey was made of all planted shrubbery, native timber, and other uncultivated lands in an area comprising more than 51,600 square miles. This resulted in the eradication of more than 1,930,340 bushes on 1,971 properties in the 13 States—Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Wyoming—which comprised the original control area, and 45,514,880 bushes in Missouri, Pennsylvania, Virginia, and West Virginia, where organized control work was not undertaken until 1935. Forty-three million, three hundred and eighty-eight thousand of these were of the species *Berberis canadensis*, which is native to Virginia and West Virginia but occurs only in very limited areas in States farther north.

PRESENT STATUS OF CONTROL WORK

The status of the eradication program varies considerably in different States within the control area and in different areas within individual States. In Montana, Wyoming, North Dakota, South Dakota, and parts of Colorado and Nebraska the initial eradication

work has been completed, and plans have been outlined to prevent reinfestation in those areas where barberry seed was distributed by natural agencies before the original bushes were destroyed.

In Iowa and in States east of the Mississippi River, where infested areas exist in far greater numbers, many of them involving all uncultivated land in entire counties, the status of the program is not so far advanced. In Iowa, Wisconsin, Illinois, Missouri, Minnesota, Indiana, Ohio, and Michigan an intensive survey has been made of about 60 percent of the counties needing attention. In these States, as in those farther west, detailed records, including maps, have been kept of all locations where barberry bushes were found, thus simplifying reinspections of infested areas.

In Pennsylvania, Virginia, and West Virginia field operations have been restricted to the more important grain-growing valleys, and striking results have been obtained in localized areas where bushes have been removed. These States are not subject to the sweeping winds that frequently distribute spores for great distances in the Great Plains region, and whenever bushes are destroyed there is a marked reduction in the amount of rust that occurs the following year.

Table 9 summarizes, by States, progress in barberry eradication during the year.

TABLE 9.—*Progress in barberry eradication by States, fiscal year 1939*

State	Counties surveyed	Area surveyed	Properties cleared of bushes	Barberry bushes destroyed	Salt used
	Number	*Square miles*	*Number*	*Number*	*Tons*
Colorado	5	873	81	1,752,674	48.91
Illinois	13	7,044	237	2,481	8.04
Indiana	30	4,300	131	9,834	5.71
Iowa	26	5,488	260	3,460	26.34
Michigan	16	1,674	473	78,888	56.68
Minnesota	20	5,027	203	7,513	27.58
Montana	3	1,200	15	2,716	1.64
Nebraska	18	6,700	33	112	.39
North Dakota	6	2,309	8	1,000	.37
Ohio	23	5,524	227	34,302	13.87
South Dakota	5	5,510	4	31	0
Wisconsin	15	1,499	299	37,332	28.85
Wyoming	5	252	0	0	0
Total	185	47,400	1,971	1,930,343	218.38
Missouri	7	1,312	46	1,220	.98
Pennsylvania	10	2,398	1,453	2,125,021	434.97
Virginia	12	236	420	16,373,150	1,028.01
West Virginia	7	290	258	27,015,489	1,060.69
Total	36	4,236	2,177	45,514,880	2,524.65
Grand total	221	51,636	4,148	47,445,223	2,743.03

RUST-SUSCEPTIBLE BARBERRY BUSHES EXCLUDED FROM INTERSTATE TRADE BY FEDERAL QUARANTINE

The object of Quarantine 38 (revised) is to prevent, through education and regulation, the interstate movement (into or between States comprising the protected area) of rust-susceptible species of barberry. During the spring of 1938, 47 nurserymen planning interstate shipment of immune species of *Berberis* and *Mahonia* (other than *B. thunbergii*) applied to the Bureau for the necessary Federal permits.

As a result of the inspection of 11,400 acres of nursery stock, 23,750 rust-susceptible barberry bushes were destroyed. Forty nurseries were found to meet quarantine requirements, and interstate shipping permits were granted. Two failed to qualify, 2 required no permits, and no action was taken in regard to 3 nurseries where further clean-up work is necessary.

A year ago a review of nursery catalogs on file in the Department of Agriculture Library indicated that about 40 nurseries (all outside the quarantined area) were advertising susceptible species of barberry for sale. This number has now been reduced to about 30, and it is expected that within a very few years practically all nurseries will have discontinued the sale of other than immune species.

Again this year all available species of barberry not definitely classified with respect to their reaction to the stem-rust fungus were inoculated under natural conditions. There are known to be more than 150 different species of barberry in the United States, most of which have been introduced from foreign countries. Of this number, only 32 are immune to attack by the stem-rust fungus.

STEM RUST PREVALENT OVER LARGE AREA IN 1938

Again in 1938 stem rust of small grains became epidemic over extensive areas from Texas to the Canadian border. However, owing to the predominance of the rust-resistant Thatcher wheat in Minnesota and certain sections of North Dakota and hot, dry weather that checked the development of the fungus and matured crops prematurely in South Dakota and certain parts of North Dakota, rust losses in the spring wheat area this year were not nearly so great as in 1935 or 1937.

A discussion of the factors contributing to the epidemic of 1938 must include some mention of rust observations made in the fall of 1937. Stem rust was prevalent on late oats, volunteer grains, and certain native grasses, particularly wild barley (*Hordeum jubatum*) in southern Minnesota, Iowa, and northern Missouri in August 1937. There is evidence that from here rust spores were blown southward early in the fall, for infection was found on volunteer oats near Guthrie, Okla., on October 24, and at several points in Oklahoma and Kansas a month later. There is little doubt that fall-sown grains in Texas and northern Mexico became infected late in the season and that the rust survived the winter of 1938–39 in the uredial or spreading stage.

To determine, if possible, the extent to which rust in Mexico contributed to the development of the disease later in the season in Texas and States farther north, a rust survey, conducted in cooperation with representatives of the Instituto Biotecnico, Mexican Department of Agriculture, was made in February, and again in April, of the more important grain-growing areas in Mexico.

Specimens of rusted grain were obtained from representative localities within each geographical area and studies made to determine the particular races of the fungus that were present. Southern Mexico apparently did not contribute to the epidemic in the United States in 1938, nor could it have furnished all the inoculum for northern Mexico. With the exception of one collection of race 24, only races 59 and 38 were identified from specimens obtained in southern Mexico in 1938.

In this area Marquis wheat, which is extremely susceptible to races of stem rust now prevalent in the spring wheat area of the United States, has been grown for several years because of its rust resistance. It is significant, therefore, that Marquis is not susceptible to the races of rust that were identified from rusted grains collected in southern Mexico. Of the nine different races found in northern Mexico, all were subsequently found in the United States.

CONDITIONS FAVORED NORTHWARD MOVEMENT OF RUST IN 1938

Stem rust was first observed in Texas in the spring of 1938 on February 2 at College Station. It was later determined that a scattering of rust had appeared in San Antonio and other sections of southern and central Texas at about the same time. Near San Antonio there was considerable early grain, and, as a result of excessive rainfall, rust became abundant fairly early in the season.

During the period May 3 to 5, and again on May 17 and 18, south winds are believed to have been responsible for spore showers in Oklahoma, Kansas, Missouri, and western Illinois. On June 5 spores were trapped as far north as Fargo, N. Dak., and on June 15 infection was observed on wheat in west-central Minnesota and at Brookings, S. Dak. While there was considerable variation in the amount of rust that developed in different localities in Kansas, Missouri, and Nebraska, this area produced an abundance of inoculum which appears to have contributed materially to the epidemic that developed later in States farther north. By exposing spore traps daily at certain representative points throughout the Mississippi River Valley it was possible to determine just when spore showers occurred.

Table 10 shows the estimated number of spores trapped at representative points in the Great Plains region during 24-hour periods on the dates indicated.

TABLE 10.—*Estimated numbers of spores trapped at representative points in the Great Plains region, 1938*

Place	May 16	May 18	May 24	May 25	June 13	June 14
Oklahoma City, Okla	1,296	432	96	6,192	92,864	86,352
Beatrice, Nebr	672	3,382	1,440	528	37,296	17,040
Dallas, Tex			95,616	33,600	3,648	13,056
Madison, Wis			192	0		
St. Paul, Minn					26,688	5,568
Ames, Iowa					18,480	2,880
Brookings, S. Dak					10,800	1,824
Fargo, N. Dak					1,248	96

There was a period from May 16 to 25, inclusive, when conditions favored the northward movement of rust. Again, on June 13 and 14, south winds carried an abundance of inoculum into Northern States. Unlike the epidemic in 1937, when rust spreading from the South reached into Illinois, Indiana, and even western Ohio, the epidemic this year moved more in a northwesterly direction, eventually causing considerable damage as far west as eastern Montana.

Although more than 160 physiologic races of the stem-rust fungus have been identified during the past 15 years, race 56 was primarily

responsible for the epidemic in 1938. It was isolated from 85 percent of all the collections of rusted grains and grasses obtained in the United States and was the most prevalent form for the fifth consecutive year. Never before, since the physiologic-race survey was undertaken on an extensive scale, has any single race of rust been so predominant. While 4 other races (38, 19, 17, and 11) were rather widely distributed, varieties of grain resistant to race 56 in general escaped serious rust damage.

BARBERRY BUSHES RUSTED HEAVILY IN 1938

Before rust appeared on grains in southern Oklahoma barberry bushes in the Northern States were becoming infected. Both the pycnial and aecial stages of the fungus were observed on barberries in Missouri by May 5, in Illinois by April 20, in Iowa and Nebraska by April 29, in South Dakota by May 27, in Minnesota by May 6, and in North Dakota by June 6. Rust was spreading from barberry bushes to nearby grains and grasses in these States 4 to 6 weeks before infection became general on grain away from known bushes.

Further evidence was obtained in 1938 to indicate that new hybrid races of the stem-rust fungus may be produced at the time infection occurs on the leaves of the barberry. These hybrid races may prove capable of attacking new and improved varieties of grain that have been tested and found resistant to both parent races of the fungus.

In 1938, as in previous years, many instances were encountered in which local epidemics of stem rust could be traced directly to the barberry bushes that were responsible for the initial inoculum.

FIELD DEMONSTRATIONS CONDUCTED FOR EDUCATIONAL PURPOSES

Educational work in connection with the barberry-eradication program in recent years has been conducted largely to stimulate the interest of property owners in keeping their lands free of barberry bushes once the initial eradication work has been completed. Frequently it has been possible, in cooperation with county extension agents and representatives of State departments of agriculture, to arrange field demonstrations where farmers and local businessmen could observe the damage caused by a few barberry bushes so situated as to spread rust directly to grain crops. Such demonstrations held in Iowa, Minnesota, Wisconsin, and Pennsylvania have created much interest in the objectives of the regional program. Each demonstration has been held just at the time that fan-shaped spreadings of rust could be traced directly to the bushes serving as the source of inoculum. Similar demonstrations of actual eradication of barberry bushes, to show farmers how much chemical is required to kill bushes and the proper methods of applying it, were held in several States.

Again this year information concerning the development and spread of stem rust was submitted to the Department Press Service weekly during the growing season. More detailed reports were made available at frequent intervals to various units of the Department interested in current crop conditions.

TRUCK CROP AND GARDEN INSECT INVESTIGATIONS

TOMATO FRUITWORM

In the summer and fall of 1938 the investigations on the tomato fruitworm were continued on a comparatively large scale in California, Utah, and southern Indiana, and the following discussion applies to the results obtained during that period. During the course of these investigations a series of experimental tests were performed with materials containing rotenone, particularly derris and cube, and with phenothiazine, cuprous cyanide, copper arsenate, copper cyanamide, cryolite, calcium arsenate, and several other materials. All these insecticides, except those containing rotenone, were of some value in reducing injury done by the tomato fruitworm, but cryolite and calcium arsenate gave the best results. While the degree of crop protection attained by using cryolite and calcium arsenate in dust mixtures, spray mixtures, and poisoned baits varied considerably in different seasons and on different farms, the indications were that the best yield of uninjured fruit was obtained when a cryolite-dust mixture containing 70 parts by weight of cryolite and 30 parts of talc was used. In these tests natural cryolite which contained approximately 90 percent of sodium fluoaluminate and one brand of synthetic cryolite containing approximately 98 percent and another containing approximately 83 percent of sodium fluoaluminate were employed. In replicated experiments on several varieties of tomatoes and in several different fields the application of the cryolite-dust mixtures resulted in a degree of control which ranged from 30 to 90 percent. These figures are based on the percentage of fruits damaged by the fruitworm in treated plots as compared with the percentage damaged in plots that were either dusted with a cube dust mixture or left undusted. Some of the check plots in the fields where these experiments were performed were threatened by the tomato pinworm, and in order to prevent serious loss to the grower from this source applications of cube dust were made, as this material was known to be partly effective against this insect, but would not affect the tomato fruitworm; consequently the application of these cube dusts did not seriously affect the results of insecticidal tests against the tomato fruitworm. Three brands of calcium arsenate were used and these gave control ranging from 30 to 64 percent on the same basis of comparison as stated previously. It will be noted, therefore, that calcium arsenate was slightly inferior to cryolite although in laboratory tests it appeared that the former material was as toxic to quarter-grown larvae of the fruitworm as was cryolite.

The highest degree of tomato fruitworm control was achieved with cryolite-dust mixtures when three applications were made at 2-week intervals, beginning when the foliage of the tomato plant was about 1 foot in diameter. In California, where on an average an acre of tomatoes contained 1,000 plants, approximately 10 pounds of the dust mixtures was used for the first application, 20 for the second, and 30 for the third, per acre. Both power dusters and fan-type hand dusters were used to apply the materials, and the plants were dusted from both sides at each application. A special attempt was made to cover all the foliage, since extensive biological observations have

demonstrated that the eggs are deposited principally on the upper and lower surfaces of the tomato leaves around the periphery of the plant.

A poisoned bait prepared by mixing thoroughly 1 pound of cryolite and 10 pounds of bran with 1 quart of corn oil was nearly as effective as the cryolite-dust mixture. The bait was applied by hand and an attempt made to scatter the material lightly and evenly over the leaves of the entire plant. Three applications were made at the same time and same time intervals as were employed with the dust mixtures. Approximately 40 pounds of the bait was used per acre for each of the first two applications and from 60 to 70 pounds for the third application.

Although several baits containing different poisons, mixed with corn meal, or with bran and corn oil, were tried in one field with rather poor results, research on these baits will be continued, since the cost of these materials per acre is approximately the same as for the dust mixtures, and growers appreciate the ease and speed of application without the use of special equipment. The indifferent control obtained with these baits may be attributable to an uneven rate of crop development in the field where they were tested, since the results were contrary to those recorded in the corresponding period of 1937. It has been found, however, that since corn meal, bran, and sawdust vary greatly in weight per unit of volume, it will be necessary to vary the composition of poisoned baits containing each of these materials to compensate for their variation in density. In general the sawdust baits are much lighter per unit of volume than those containing corn meal or bran.

Sprays containing cryolite diluted at the rate of 8 pounds to 100 gallons of water plus a sticking or wetting agent gave a fairly effective degree of control of the fruitworm. Although the results obtained with a dust mixture containing 40 percent of phenothiazine were rather unsatisfactory, the indications were that this material has possibilities as an insecticide for combating the tomato fruitworm if a suitable sticker can be found to make it adhere to the plants. Cuprous cyanide gave comparatively poor results against the tomato fruitworm, and copper cyanamide gave only fair control.

Laboratory tests in southern California showed that hydrated lime was safer than talc for use as a diluent for paris green on tomato foliage. It was shown also that mixtures of cryolite and calcium arsenate with talc (50–30–20) might cause some degree of burning to the tomato plant, but additional tests are necessary to obtain final information on this point. The latter combination, if it could be used safely by the growers, would have a distinct field of usefulness as a threefold insecticide for the control of the tomato fruitworm, the tomato pinworm, and the species of hornworms (*Protoparce sexta* (Johan.) and *P. quinquemaculata* (Haw.)) ordinarily found on tomatoes. These tests showed further that a poisoned-bait mixture consisting of 25 pounds of corn meal and 1 pound of a calcium salt of dinitrocyclohexylphenol was apparently not safe to use on tomato foliage, whereas a poisoned-bait mixture consisting of 25 pounds of corn meal and 1 pound of paris green injured the tomato foliage, but was rendered safe for this purpose by the addition of 1 pound of hydrated lime to the formula.

An interesting and important point learned during the progress of biological studies was that newly hatched larvae of the tomato fruitworm, in crawling over the foliage of tomatoes that had been treated with insecticides, picked up particles of such insecticides with their mandibles and also cleaned off their feet by drawing them through the oral aperture, indicating that these larvae may be poisoned by insecticides without actually devouring the treated foliage or fruit.

The sparse infestations of the tomato fruitworm in northern Utah following a mild winter and a 16-percent survival of pupae in overwintering cage experiments emphasized the importance of the movement or migration of the moths from the South and verified the conclusion of various workers in Ohio, Illinois, and Indiana that the source of the infestations of the tomato fruitworm in northern latitudes is ordinarily the migration or movement of adults from the southern part of the country. Experiments with 17 different insecticides and toxicity tests with a bait and a dust mixture which were applied in 22 different combinations of time of season, interval between applications, and number of applications throughout the period between July 11 and September 12 were handicapped because the sparse infestation would not permit significant conclusions to be drawn on the relative efficiency of the different insecticides or treatments.

Owing to the sparse infestation of the tomato fruitworm in southern Indiana, the experiments at that point did not yield significant results regarding the relative efficiency of the different insecticides used.

The results of residue studies in California and Indiana led to the conclusion that none of the insecticidal materials used in the control of the tomato fruitworm which are likely to leave a poisonous residue on the harvested fruits should be applied within 3 weeks of the first picking. Preliminary studies indicated that if no applications are made within this 3-week period no excessive residue is likely to be present on the harvested product. In instances where a residue does occur on the fruit at harvest time, the indications are that the washing process in the cannery or the wiping of the fruit with a cloth or similar process preparatory to its marketing will practically eliminate the residue.

TOMATO PINWORM

Although the tomato pinworm continued to cause severe losses to the tomato crop in some fields of southern California during the summer and fall of 1938, such losses were not so pronounced as in previous years except in certain districts where tomatoes are grown in a succession of plantings throughout the frost-free period. Much of the improvement in the tomato pinworm situation is attributed to the activities of the growers who followed the recommendations of the Department by cleaning up and destroying tomato-crop remnants, which ordinarily function as important sources of reinfestation, and then giving the infested fields a clean plowing. This development has corroborated the experimental evidence obtained by the workers to the effect that the elimination of infested tomato-crop remnants comprised a very important item in pinworm control.

The results of extensive tests with various insecticides, involving a total of 330 field plots, corroborated previously obtained information

to the effect that cryolite and cuprous cyanide, in either sprays or dust mixtures, were the most effective stomach poisons available for use against this pest. It was found, however, that although these materials give satisfactory control of the pinworms up to the time of the early picking of the tomatoes, the degree of control ranging from 85 to 90 percent, the numerical abundance of the pest increases so rapidly when climatic conditions are favorable that 1 or 2 applications of insecticides toward the end of the picking season may be required in the presence of intense infestation as a final step in pinworm control. Ordinarily, however, 3 or 4 applications of cryolite or of cuprous cyanide appear to be sufficient to control the pinworm if they are timed properly.

The tests of 1938 disclosed that materials such as phenothiazine, cube, and derris are of doubtful value in combating the pinworm.

Biological investigations of the pinworm disclosed that in southern California the conditions prevailing during the winter have an important relation to the survival of the species, since temperatures below freezing increase greatly the rate of mortality, but that the prevalence of wet and cool weather during the spring and early summer may have such a detrimental effect on the survival of the pinworm moths and their rate of egg deposition as to counteract favorable winter conditions.

During the past two or three seasons parasites have become an important natural influence in checking the abundance of the pinworm. Two species new to science as well as two species not previously known to exist in southern California have acted as checks.

PEA WEEVIL

Extensive field experiments in controlling the pea weevil, carried on in cooperation with the States of Washington, Oregon, and Idaho during the year, again demonstrated that dust mixtures containing rotenone will protect peas against this pest if the mixtures are applied in the way recommended and at the proper time.

Special surveys in the Blue Mountain area of Washington and Oregon revealed that over four times as much dust mixture containing rotenone was used against the pea weevil in this area as was used the preceding season. In 1937 approximately 47.5 tons of dust mixtures containing rotenone, costing approximately $10,925, was used to protect peas (about 38,000 acres), whereas in 1938, with an area of approximately 34,000 acres in peas, 211.5 tons of dust mixtures containing rotenone, costing approximately $37,780, was used. The general results of the control campaigns were nearly the same, since 716 acres of peas, constituting 1.9 percent of the total acreage, were discarded in 1937 on account of pea weevil damage, whereas in 1938 the area discarded was 386 acres, or 1.1 percent of the total acreage. The decided success attained against the pea weevil during preceding seasons by the use of dust mixtures containing rotenone led to a further intensification and increased use of this materal during the spring and early summer of 1939. As illustrating the extensive use of this insecticide it may be stated that one canning company in Washington used approximately 150,000 pounds of the dust mixture costing about $6,000. Moreover, some of the larger canning companies have adopted the policy of preparing their own dust mixtures rather than purchasing commer-

cial mixtures. In preparing these dust mixtures very elaborate precautions have been taken by the growers to insure that the product, when ready for application, has the recommended rotenone content of approximately 1 percent.

In many districts of the pea weevil-infested areas of Idaho, Washington, and Oregon an innovation in entomological procedure has developed in that the growers of peas have voluntarily examined their fields repeatedly to determine what portions of the fields are infested by the pea weevil to such an extent as to warrant the application of insecticides. As a result of their experiences during the past two or three seasons many of these growers have become adept in examining their fields and in recognizing the presence of a potentially destructive pea weevil infestation. Some of the larger canning companies have employed full-time entomologists to aid in the pea weevil-control program, while others have employed trained personnel for that part of the season when technical knowledge is needed.

An outstanding accomplishment in the control activities against the pea weevil has been the development of large units of dusting equipment. Many of these units are equipped with a 50-foot boom, and during the early season of 1939 one outfit with an 80-foot boom which distributes the dust mixture uniformly throughout the entire 80-foot swath was developed by private interests. This particular unit has a hopper capacity of approximately 800 pounds of the rotenone-dust mixture and is capable of dusting approximately 250 acres per day. The use of these dusting units has led to a question regarding the extent of mechanical damage caused by their passage through the pea fields. To answer this question, a study was made in 29 typical pea fields in Washington. The resulting data indicate that dusters with a 30-foot swath pulled by caterpillar tractors with 8-inch treads caused sufficient damage to decrease the yield by about 5 percent as compared with that in fields not treated with insecticides. Horse-drawn dusters caused half or less than half this damage, and the 30-foot dusters pulled by trucks caused a decreased yield of approximately 3 percent. Although no detailed studies have been made regarding the degree of mechanical damage caused by the 50-foot or 80-foot dusters, the fact that the use of these larger units decreases the number of trips in any field has led to the general conclusion that they cause less damage than the smaller units. The comparatively small degree of mechanical damage caused by the dusting units is not held by the growers to be important in comparison with the excellent control of the pea weevil obtained by their use.

Tests in the laboratory and in the field indicated that the effectiveness against the pea weevil of dust mixtures containing rotenone was not increased by the addition of various conditioners. In general the mixtures containing 1.0 percent of rotenone were more effective than those containing 0.75 or 0.50 percent. Much less difference was noted in the toxicity to the pea weevil between dusts containing 1.0 and 0.75 percent of rotenone than between those containing 0.75 and 0.50 percent of this ingredient, particularly in tests made during the spring. These results agree in general with the limited field trials with dusts containing these percentages of rotenone. A cube-dust mixture with diatomaceous earth as a carrier did not give so high a degree of mortality of the pea weevil as cube with talc as a carrier, particularly

at the higher dosages. Near the median lethal dosage, however, there were no significant differences between the performance of these two diluents. The addition of 2.0 percent of peanut oil, 1.0 percent of sodium oleyl sulfate, and 0.5 percent of water to cube in a dust mixture with talc as a diluent did not increase the toxicity of the material as compared with a cube-talc dust mixture not containing these conditioners. A dust mixture containing 0.005 percent of sulfur nitride was nontoxic to the weevils. The addition of 0.225 percent of total pyrethrins to the cube-dust mixture with talc as a diluent, containing 0.5 percent of rotenone, markedly increased the toxicity of the resulting dust mixture to the pea weevil. During the course of these experiments it was determined that the weevils which recover from the paralysis induced by sublethal dosages of rotenone were capable of oviposition, but whether these eggs were viable was not learned. It was also disclosed that the weevils which developed during the summer were much more resistant to dusts containing rotenone than those that had been kept in storage from fall until the following spring.

As a corollary to these insecticide tests, additional data were accumulated which indicate that the toxic effect of dust mixtures containing rotenone to the pea weevil is attributable principally to the contact properties of the active ingredients, but also to the action of these ingredients as a stomach poison.

Hibernation studies following the mild winter of 1937–38 disclosed that pea weevils were able to overwinter successfully in grass, grain, weeds, weeds and straw, grain and weeds, pea-harvest debris, wheat stubble, duff from deciduous bushes, and debris from pine trees. This newly discovered information explains the presence of the weevils in areas remote from the preferred hibernation quarters in dense growths of pine and indicates the possibility of devising methods for destroying part of the pea weevil population during its overwintering period.

Studies conducted in Oregon on the flight habits of the pea weevil with the aid of a rotary mechanical trap revealed that the magnitude of weevil flight is governed by three major factors—temperature, time of day, and season of the year. It was disclosed that the peak of flight activity occurred only when the temperatures reached 68° to 74° F. or higher and that these flights reached their daily peak late in the morning and early in the afternoon. The flight of the weevils is practically stopped when the daily maximum temperature fails to rise higher than 66° to 74°. In general the magnitude of daily flights was found to be correlated directly with daily maximum temperature. It required a higher range of temperature to stimulate the weevils to flight during the spring and summer than during the fall.

Although it has been shown definitely that the application of insecticides containing rotenone comprised a very effective control for the pea weevil, the annual summation of the data collected on infestations by this insect in the Palouse area of Washington and Idaho as obtained from the records of the pea-grading service of the Bureau of Agricultural Economics, cooperating with the Department of Agronomy of the University of Idaho, disclosed that on an average during 1938 approximately 12.5 percent of the dry peas examined

were found to be infested by the pea weevil. Five hundred and seventy-eight graded crops were examined. This is approximately five times the average pea weevil infestation in a comparable area during 1937 and indicates that the 1938 infestation of the pea weevil was one of the most severe on record. The marked increase appears to be attributable principally to a mild preceding winter that allowed a high rate of survival of adults and to a reduction of pea acreage in the Palouse area. This reduction apparently resulted in a higher degree of concentration of the weevil population on the relatively small area of peas available for oviposition.

Inquiries addressed by this Bureau to entomologists in New Jersey, New York, Indiana, Illinois, Michigan, and Wisconsin respecting the status of the pea weevil as a pest in those States elicited the information that in New Jersey, Indiana, Illinois, and Wisconsin the insect is ordinarily present in very limited numbers and cannot be considered an important pest. In New York and in Michigan, however, the State authorities assert that, although the pea weevil is not now abundant, serious damage has been caused by this pest in those States during the past years when peas were grown on a commercial scale by the dried-pea industry for use as seed or feed.

GLADIOLUS THRIPS

Extensive tests made during 1938 of various sprays to control the gladiolus thrips in the field and in the greenhouse led to a confirmation of the effectiveness of a tartar emetic-brown sugar spray for this purpose and its superiority to any other known insecticide. From these tests the following conclusions were reached: (1) Tartar emetic-brown sugar sprays, whether composed of 2, 3, or 4 pounds of tartar emetic and 8 or 16 pounds of brown sugar per 100 gallons of spray, were of practically equal efficiency. On plots sprayed with 2 pounds of tartar emetic there appeared to be less residual effect of the tartar emetic than where 4 pounds was used; hence the thrips caused more injury later in the flowering season on plots where the lower dilutions were used. No injury to gladiolus foliage resulted from the tartar emetic sprays, and the degree of control achieved was equal to that obtained with sprays containing paris green and brown sugar. (2) While a satisfactory degree of control was obtained with sprays containing 2 pounds of paris green and 64 pounds of brown sugar per 100 gallons of water, this spray caused moderate to severe foliage injury, the magnitude of which varied with the variety of gladiolus involved. (3) Sprays containing derris and peanut oil not only failed to give a satisfactory control of the gladiolus thrips, but made the normal green surface of the foliage oily, and dust covered and yellowed it. The plants sprayed with this combination were also stunted and retarded for more than a week in the development of their flower spikes. The plants treated with a derris root powder spray containing 0.02 percent of rotenone were more adversely affected by thrips and by the insecticide than those treated with a derris root spray containing 0.015 percent of rotenone, even though peanut oil was used at a concentration of 1 percent in both sprays. (4) A spray composed of derris root powder containing 0.015 percent of rotenone, with varnish as a sticker, plus a sodium sulfate of technical lauryl alcohol as a wetting agent, gave only partial control of the thrips. (5) A spray

containing tartar emetic alone at the rate of 4 pounds to 100 gallons of water gave no appreciable control of the thrips, demonstrating the necessity of using some type of sweet substance in the spray to obtain satisfactory results. In this connection no attempt has been made thus far to determine the comparative effectiveness of brown sugar and other easily available sweet substances that might be used in combination with tartar emetic as a spray for gladiolus thrips control. (6) A spray containing nicotine sulfate (1 to 500) with karaya gum (1 to 500) was also ineffective, as was tartar emetic, at a dilution of 4 pounds to 100 gallons of water with a commercially prepared sodium oleyl sulfate as a wetting agent.

In tests to determine the quantity of mercuric chloride (corrosive sublimate) that is absorbed by the gladiolus corms when they are soaked in a solution of this chemical in the spring to combat any thrips that may be resident thereon, it was found that from 37 to 69 percent of the chemical was removed from a 1 to 1,000 solution, in the presence of temperatures of 60° and 70° F., respectively, when the gladiolus corms, encased in burlap bags, were immersed in the liquid for a period of 17 hours. No significant differences could be detected between the results obtained at the two solution temperatures. Attempts to use the solutions for a second bath of corms, by recharging with approximately one-half the original quantity of the chemical, by weight, resulted in the production of solutions of varying strength which could not be relied upon to kill gladiolus thrips on the corms. It was concluded, therefore, that to obtain a satisfactory reaction from the mercuric chloride treatment a fresh solution should be prepared for each batch of corms to be treated.

RELATIVE VALUE OF VARIOUS INSECTICIDES IN COMBATING PESTS OF VEGETABLES, BERRIES, TOBACCO, AND ORNAMENTALS

During the progress of experiments to determine the identity and proper dilution of insecticide materials that would control certain of the pests attacking vegetables, berries, tobacco, and ornamentals and not leave harmful residues on the market product or injure the plant seriously, it has become apparent that some of these materials are characterized by specific responses, as disclosed by tests in the laboratory and in the field.

For example, it was found that pyrethrum is very effective against the celery leaf tier, whereas derris is noneffective, and lead arsenate and cryolite are not sufficiently effective against the half-grown or nearly full-grown stages, at the dilutions ordinarily considered practicable, to warrant the risk of residue hazard incurred by their use. On the other hand, comparable tests with these four insecticides showed that derris and pyrethrum were highly specific against all stages of the imported cabbage worm and much more effective than either lead arsenate or cryolite. These results emphasized that the organic insecticides enumerated could be used in controlling this important pest of cole crops without danger of harmful residue and that the other materials were not so suitable.

In experiments for controlling the southern armyworm it was found that to the insect at quarter-grown or larger stages either pyrethrum or derris was very nearly nontoxic, but that either cryolite or lead arsenate was specific against this widely distributed pest of many vegetable

crops in the South. Either pyrethrum or derris was effective against the newly hatched larvae of the southern armyworm, but the degree of efficiency decreased rapidly after the larvae had reached the quarter-grown stage.

In addition to being effective in combating the tomato fruitworm, tomato pinworm, southern armyworm, celery leaf tier, and imported cabbage worm, cryolite has given indications of being useful in combating hornworms on tobacco. For this purpose a dust mixture containing 80 percent of cryolite is used, or a spray is made with 6 pounds of cryolite containing 85 percent of active ingredients and 50 gallons of water. It appears that cryolite is not so likely to burn or discolor the plant or leave an objectionable residue on the harvested product as paris green or other arsenicals commonly employed.

Although during the season of 1937 cryolite was used successfully as a dip for tobacco plants prior to setting, to protect them from injury by the corn root webworm, a serious pest of tobacco in many districts, the work in 1938 did not verify the results of the previous year. Some indications were obtained that cryolite may be of value in the control of the tobacco flea beetle, the strawberry weevil, and the beet armyworm. When used as a spray or as a dust mixture cryolite has not proved so effective against the Mexican bean beetle as derris or cube, but it was more effective than either derris or cube in controlling the corn earworm on lima beans.

Because of its chemical composition, cryolite is difficult to apply as a dust mixture, and it seems essential that some carrier be used with it to improve its dusting qualities. The indications are that if a satisfactory degree of insect mortality is to be obtained with cryolite it must not be diluted more than 50 percent. Although in general the synthetic and natural forms of cryolite have been almost equally toxic when tested on properly replicated plots, there have been occasions when a commonly used domestic brand of synthetic cryolite seemed superior to a widely distributed imported brand of the synthetic material.

While insecticides containing rotenone derived from derris, cube, or devil's shoestring (*Tephrosia*) have proved effective against such insects as the Mexican bean beetle, imported cabbage worm, cabbage looper, diamondback moth, pea aphid, turnip aphid, pea weevil, raspberry fruitworm, tobacco flea beetle, common red spider, and certain species of thrips (*Thrips tabaci* Lind., *Heliothrips haemorrhoidalis* (Bouché), and *Taeniothrips xanthii* Williams) on greenhouse-grown cucumbers and tomatoes, they have not proved effective against the celery leaf tier, southern armyworm, tomato fruitworm, tomato pinworm, tomato and tobacco worms, zebra caterpillar, mole crickets (*Scapteriscus* spp.), sweetpotato weevil, cutworms, and leafhoppers. In general, derris and cube, when containing approximately the same total active ingredients, have given approximately the same degree of efficiency against any given insect.

In special tests it was shown that sprays containing lead arsenate were superior to sprays containing derris, phenothiazine, or sulfur nitride for the control of the Colorado potato beetle.

Some of the commercially prepared organic thiocyanates have given promising results against the more common species of mealybugs and the common red spider, although causing a variable degree of injury to some species of susceptible plants.

Solutions of dichloroethyl ether have given encouraging results as a soil insecticide against the sugar-beet wireworm and the Pacific coast wireworm as well as the raspberry root borer.

Sprays of phenothiazine were fairly effective against the tomato fruitworm, Mexican bean beetle, and southern armyworm, and slightly useful against the tomato and tobacco worms. This material was also highly toxic to the raspberry fruitworm but caused such serious injury to the raspberry plants as to preclude its further use for the purpose.

In limited experiments metaldehyde proved very effective against slugs and snails in Maryland and California.

SWEETPOTATO WEEVIL CONTROL AND ERADICATION

The program which was begun in July 1937 to eradicate the sweetpotato weevil from areas of commercial production where wild host plants do not persist through the year was continued, and inspection was extended to areas not previously scouted for the pest. Surveys were conducted during the year in 62 counties in Alabama, Georgia, Mississippi, and Texas, 24 of which were found to have infestation in seedbeds, fields, or stored potatoes.

Eradication activities included the destruction of infested seedbeds, clean-up of infested fields and storage places, and the destruction of volunteer sweetpotato plants on infested and adjacent properties. In Alabama native host plants were eradicated from extensive areas along the coast by relief labor under a State-sponsored W. P. A. project.

The regulations of the standardized State quarantine were strictly enforced in cooperation with the States.

COTTON INSECT INVESTIGATIONS

In March 1939 the laboratory for the investigation of the cotton flea hopper at Port Lavaca, Tex., and in June the laboratory for investigation of the cotton bollworm at College Station, Tex., were closed and the work was consolidated with headquarters at Waco, Tex. Both insects are normally serious pests of cotton in the Blacklands section, and large areas of cotton on both river-bottom and prairie land, typical of central Texas, are available for conducting experiments in the vicinity of the new station. In addition, investigations will be undertaken in cooperation with the Soil Conservation Service on their Blacklands Experimental Watershed (Brushy Creek project) to determine the relation of conservation measures to the abundance of cotton insects, and for developing cultural practices for their control.

In June 1939 an employee of the Division was transferred to the lower Rio Grande Valley of Texas to secure information on the life history and habits of the pink bollworm in the new environment for immediate use in the eradication program to be undertaken by the Division of Pink Bollworm and Thurberia Weevil Control.

BOLL WEEVIL

Although the damage caused by the boll weevil in 1938 was almost double that of 1937, it was about 2 percent less than the average

annual damage for the United States during the last 25 years. The severest damage since 1932 occurred along the Atlantic seaboard in Virginia, North Carolina, South Carolina, Georgia, and Florida, but in other sections a hot, dry period during the first half of July temporarily checked a high early-season infestation and permitted the early-planted cotton to mature before the weevils became sufficiently abundant to cause great injury, although late-planted cotton was seriously damaged. Large areas of cotton in the central and western parts of the Cotton Belt were defoliated by the leaf worm during September 1938, and this greatly reduced the numbers of weevils entering hibernation. At Tallulah, La., only 4 live boll weevils per ton of Spanish moss were found in the fall of 1938 as compared with 51 weevils per ton in 1937. This was the smallest number of weevils per ton of Spanish moss in the fall since the examinations were begun in 1925. In the eastern part of the belt defoliation by leaf worms was light, and large numbers of weevils went into hibernation. At Florence, S. C., winter examinations of trash from woods adjacent to cottonfields revealed 3,582 weevils per acre as compared with 1,476 in 1937. Most of the weevils were found in trash within 100 feet of the edge of the woods. The survival in hibernation cages during the winter of 1938–39 was somewhat lower than during 1937–38 and also lower than the average survival for the last 8 years. At Florence the survival was 2.54 percent, at Tallulah 1.16 percent, and at College Station 2.56 percent. At Florence weevils again emerged from hibernation in nature much later than in the cages. Eighty percent of the emergence in the cages occurred during May, whereas only 10 percent of the total number of weevils collected in a trap plot of cotton were taken during May and 33 percent after June 15, when squares were present.

In experiments in boll weevil control in Tallulah, in which over a period of years the standard treatment of calcium arsenate dust had been used after 10 percent of the squares had become infested, the average gains for the year were 188 pounds of seed cotton per acre, or 9.6 percent, as compared with an 18-year average of 322 pounds. Experiments were continued in several localities with mixtures of calcium arsenate and other materials that might control the boll weevil with smaller quantities of arsenic and at the same time control the cotton flea hopper, leaf worms, and other insects. At Florence, where the boll weevils were abundant and flea hoppers very scarce, plots dusted with mixtures of calcium arsenate and lime (1 to 1 and 1 to 2) made an average gain of 352 pounds of seed cotton per acre; those dusted with calcium arsenate and sulfur (1 to 1 and 1 to 2), a gain of 484 pounds; and those treated with calcium arsenate undiluted, 522 pounds. At State College, Miss., where the boll weevil infestation was moderate and cotton flea hoppers and the rapid plant bug scarce, the infestation and yield records showed no significant differences between the insecticides; in late-planted cotton, where the weevil damage was heavy, use of the 1-to-1 mixture of calcium arsenate and sulfur brought about a gain of 666 pounds of seed cotton per acre, as compared with 626 pounds when undiluted calcium arsenate was used. At Tallulah, where the weevil infestation was light and the tarnished plant bug and rapid plant bug more abundant than in Mississippi, the gain from mixtures of calcium arsenate and sulfur (1 to 1 and 1

to 2) applied at the rate of 12 pounds per acre was 212 pounds per acre, or the same as from calcium arsenate, undiluted, applied at the rate of 4 to 6 pounds per acre; on late-planted cotton in which boll weevils were abundant and the rapid and tarnished plant bugs fairly abundant, sulfur dust alone was responsible for an increase of 105 pounds of seed cotton per acre; calcium arsenate-sulfur (1 to 1) for 488 pounds, and calcium arsenate, undiluted, for 438 pounds.

At College Station, Tex., with a light boll weevil and light flea hopper infestation, the use of calcium arsenate-sulfur mixtures (1 to 1 and 1 to 2) resulted in gains of 337 pounds of seed cotton per acre, and the use of calcium arsenate, undiluted, in 379 pounds.

Cage tests for the control of the boll weevil in which calcium arsenates containing low, intermediate, and high percentages of water-soluble arsenic pentoxide as determined by the New York method were continued, the average net mortalities for the 2 years being 60 percent with the low (0.4 percent), 78 percent with the intermediate (4.5 percent), and 76 percent with the high (10.5 percent). A cooperative field test of these high, intermediate, and low calcium arsenates was made at six stations of the Division and at the Texas Agricultural Experiment Station. In all, 8 tests, consisting of a total of 45 replications for each treatment, representing different climatic and boll weevil conditions, were made. Randomized-block plot arrangements were used, the plots being one-thirtieth of an acre in area. Statistically, the square infestations and yields did not differ in the plots receiving calcium arsenates containing low, intermediate, and high percentages of water-soluble arsenic pentoxide. However, both high and intermediate calcium arsenates appeared to be slightly more toxic to the weevils in cage tests, whereas in field tests the yields in plots dusted with the low were slightly better. Since the results obtained in the field plots are not in accord with those of the cage tests, the tests are being repeated this year in an attempt to find which type of calcium arsenate is best under field conditions.

The addition of several wetting agents to calcium arsenate and cryolite dusts did not significantly affect the insect mortality in cage tests. Dicalcium arsenate caused a significantly higher boll weevil mortality in cage tests than did tricalcium arsenate and commercial calcium arsenate.

In field tests with cryolite conducted at Florence, Tallulah, and College Station much better control was secured than last year, and material containing a high percentage of sodium fluoaluminate was more effective than that used previously. The physical qualities of the cryolites are very poor for dusting.

Continued experiments on boll weevil control on sea-island cotton at Tifton, Ga., and Gainesville, Fla., where the infestations were heavy in 1938, again demonstrated that adequate protection against the late-season migratory weevils constitutes the crucial problem in control on long-staple cotton. At Gainesville the best control was secured by using a spray of calcium arsenate (10 pounds to 50 gallons of water) applied with small compressed-air sprayers at the rate of 20 to 30 gallons per acre. The yield was increased 127 percent. The second-best gain was obtained with calcium arsenate dust—119 percent over the checks. At Tifton spraying with 5 pounds of calcium arsenate to 1 gallon of cane syrup and 49 gallons of water gave good

control prior to migration but did not protect the bolls from attack. At both localities undiluted calcium arsenate dust gave better control than the diluted dusts, and mopping with sweetened poison was again entirely inadequate for protection against the weevils.

SOIL INJURY FROM CALCIUM ARSENATE AND CRYOLITE

The 1938 yield of cotton on the plot at Tallulah which received 400 pounds of calcium arsenate per acre from 1931 to 1935, or a total of 2,000 pounds, was less than that on the untreated check, probably owing to the reduced growth in 1937 of Austrian Winter peas and hairy vetch planted for green-manure crops. During the winter of 1938–39 Austrian Winter peas, vetch, and oats planted as winter cover crops produced as much on the treated as on the untreated plots for the first time since the experiment was begun. It appears that the injurious effects of arsenic on the soil disappeared after 4 years. On the plots representative of the seven major soil types of Mississippi, previously reported, the effects of arsenic added in April 1935 seem to be disappearing as a result of fixation or leaching of the arsenic, and the yields from crops susceptible to arsenical injury are increasing. Preliminary tests with cryolite on light sandy soils especially susceptible to arsenical injury indicate that applications up to 2,000 pounds per acre had no deleterious effect on the germination or growth of cowpeas and oats.

COTTON FLEA HOPPER

There was a very heavy infestation of the cotton flea hopper in southern Texas, and the gains from dusting experiments in 1938 were the highest ever obtained. The average gain from dusting with several insecticides on thirty-six 1-acre plots was 311 pounds of seed cotton (53 percent) over the checks, and the net profit was $9.74 per acre. The maximum gain of 680 pounds and a profit of $25.11 per acre followed dusting with a mixture of 1 part of calcium arsenate and 2 parts of sulfur, and showed that this mixture is superior to other proportions of calcium arsenate and sulfur and to sulfur alone. This mixture is now being used extensively by growers, the applications being made from airplanes and ground dusting machines. Very finely divided or "micronized" sulfur dusted at the rate of 7 pounds per acre was as effective as 15 pounds of ordinary 325-mesh dusting sulfur. Mixtures of sulfur and barium fluosilicate or cryolite were not effective against the flea hopper.

HEMIPTEROUS INSECTS

The hemipterous insects continue to be the most important insect enemies of cotton in Arizona. Among the more important species are the pentatomids *Euschistus impictiventris* Stål, *Chlorochroa sayi* Stål, and *Thyanta custator* (F.) and the mirids *Lygus hesperus* Knight, *L. pratensis oblineatus* (Say), *L. elisus* Van D., and *Creontiades femoralis* Van D. The last species was more abundant on cotton in 1938 than in previous years. The pentatomids feed on the larger bolls, causing malformation and staining of the lint by the introduction of pathogenic organisms. A survey of the cotton in the State showed that 31.5 percent of the bolls of short-staple and 14.6 percent of those of long-staple cotton had been punctured. The mirids injure

the terminal buds of the plants and also cause shedding of large numbers of squares and small bolls. Further studies on seasonal abundance and host-plant relationships confirmed previous observations that alfalfa, sugar beets grown for seed, grain sorghum, and desert vegetation are the principal sources of the populations that move to cotton during the latter part of June and in July. Accurate determination of the populations, as a basis for beginning control measures, is difficult, and no satisfactory method has been developed.

Major attention was given in 1938 to field tests on the relative efficiency of the insecticide which had previously given the best results, the number of applications, and intervals between dusting for the most economical gains. Tests were conducted with sulfur dust and with dust mixtures of paris green and sulfur (1 to 12) and calcium arsenate and sulfur (1 to 4) in three sections of the State. The gains from the control experiments, while not so large as in 1937, resulted in profitable increases in yields and better grades of cotton when 5 to 9 applications of 15 to 18 pounds of insecticides were applied at 7-day intervals. Applications at 7-day intervals gave better results than those at 14-day intervals.

At Mesa, where the infestation was very light, the gains were as follows: From the paris green-sulfur mixture, 375 pounds of seed cotton per acre, or an increase of 14.4 percent; from calcium arsenate and sulfur, 168 pounds, or 6.5 percent; from sulfur, 157 pounds, or 6 percent.

At Buckeye, where the infestation was moderate, the gains were as follows: From sulfur, 1,620 pounds, or 102 percent; from calcium arsenate and sulfur, 791 pounds, or 41 percent; from paris green and sulfur, 392 pounds, or 31 percent.

In the Yuma Valley, where the infestation was heavy, the final yields from the experiments were unfortunately not obtained. However, in the first picking the best gain was from the calcium arsenate-sulfur mixture, where the increase was 549 pounds of seed cotton per acre, or 28 percent over the checks.

An entire farm of 3,133 acres of cotton near Tucson was dusted by airplane under the general supervision of the Bureau, and while no checks were left, the management was so well pleased with the results that the entire acreage will be dusted again in 1939 if necessary.

BOLLWORM

The bollworm infestation at College Station, Tex., was again late, and the control experiments were limited to the second brood of worms, which appeared on late-planted cotton during August. No rain occurred from July 8 to October 17, and cotton began wilting and shedding squares; consequently a heavy bollworm infestation did not develop. The insecticides tested in 1938 were calcium arsenate, barium fluosilicate, and synthetic cryolites containing from 20 to 90 percent of sodium fluoaluminate. Three applications of each were made at 5- to 7-day intervals beginning on August 7, when an average of 28 bollworm eggs per 100 terminal buds were present. The control from the calcium arsenate and barium fluosilicate was equal, resulting in an increase of 366 and 371 pounds of seed cotton per acre, or 41 percent. The gains from the cryolite containing 20 percent and 85 percent of sodium fluoaluminate were likewise approxi-

mately equal, the increases being 204 and 210 pounds, or 23 percent. The cryolite containing 90 percent of sodium fluoaluminate increased the yield 12.5 percent, and a cryolite with coarse particles containing 78 percent of sodium fluoaluminate, only 9.5 percent. In comparisons of calcium arsenates containing high (10.5 percent), medium (4.5 percent), and low (0.4 percent) water-soluble arsenic as determined by the New York method the increases in yields over the checks were 402, 309, and 531 pounds of seed cotton, respectively.

In tests at College Station extending over 10 years calcium arsenate dust applied at the rate of 8 to 10 pounds per acre, beginning when from 25 to 35 eggs per 100 terminal buds are present and repeated at 5-day intervals as long as oviposition continues, has proved the most effective and economical for control of the bollworm. The effectiveness of the insecticide depends on the distribution and timeliness of the application.

PINK BOLLWORM

The infestation of the pink bollworm in the Big Bend area of Texas in 1938 was much heavier than in previous years. A very early fall clean-up of the crop debris, together with overflows from the Rio Grande in July and September, which left the soil unusually moist, materially reduced the number of worms entering hibernation and the winter survival and resulted in a low carry-over to the spring of 1939. Experiments to determine the percentage of worms going into hibernation at different dates showed that 0.33 percent of the larvae issuing from green bolls between September 1 and 15, 7 percent of those issuing between September 16 and 30, and 20 percent of those issuing between October 1 and 15 were of the long cycle. The experiments were interrupted by the floods but clearly indicate the value of the early fall destruction of cotton stalks, since it is known that practically all the larvae maturing later in the season go into hibernation. Larvae in bolls plowed under 6 inches deep early in December, in fields afterwards given two winter irrigations, again had the lowest survival. The time and rate of moth emergence in the spring were influenced by the temperature and the amount of moisture in the soil. When the larvae were kept over winter under optimum moisture conditions or the moisture was increased in the spring by an irrigation, they pupated earlier and moth emergence was completed sooner than when soil moisture was low. There was a higher survival in heavy adobe soils than in light sandy soils, and in cocoons left on the soil surface than in those buried 2 to 6 inches deep. Bolls of *Thurberia thespesioides* were readily attacked by the pink bollworm when grown in close proximity to infested cotton, and moths emerged from larvae overwintering in bolls kept in hibernation cages.

In the work with parasites, the stocks of the Hawaiian strain of *Microbracon mellitor* (Say) were liberated and breeding of this species was discontinued for the present. A total of 93,000 *M. nigrorufum* Cush. and 497,000 *Chelonus blackburni* Cam. were liberated during the year in the Presidio Valley of Texas and the Laguna and Las Delicias districts of Mexico. The liberations were made in Texas early in the season, but the shortening of the breeding period by floods and early clean-up made conditions very unfavorable. Both species were recovered near the points of liberation, but definite establishment has not been determined.

Insecticide tests in which arsenicals, fluorine compounds, fixed nicotine, and phenothiazine dusts were used were continued on small plots arranged in Latin squares. On the basis of the reduction in the numbers of worms per boll the fluorine compounds and fixed nicotine gave more promising results than any of the other insecticides that have been tested at Presidio.

ROOT APHIDS

Of the three species of root aphids injurious to cotton, *Trifidaphis phaseoli* (Pass.) causes the most severe damage. There appears to be a correlation between the presence of the aphids and the incidence of seedling diseases. In control experiments directed against the aphids and the attending ant (*Lasius niger neoniger* Emery), the following have been used: (1) Repellents applied to the seedbed before planting and around the plants, (2) fumigants applied before and after planting, and (3) poisoned baits for the ants. The repellents and fumigants tested included oil of tansy, oil of sassafras, oil of anise, oil of lemon, kerosene, tincture of asafetida, flake naphthalene, derris, sulfur, tobacco dust, paradichlorobenzene, ethylene dichloride, and dichlorethyl ether emulsified with fish-oil soap in water. On the plots treated with paradichlorobenzene, the germination was very poor and the plants were stunted. The oil of tansy treatment delayed germination about 24 hours, whereas the derris hastened germination by 24 hours. No effect on the germination was noted as a result of the other treatments. The paradichlorobenzene was also the only treatment that controlled the aphids.

The ant poisons used were varying amounts of thallium sulfate, thallium acetate, and tartar emetic in sweetened baits made with sugar and honey or honey and water. The poisons, absorbed on strips of blotting paper, were exposed on the soil or in perforated tins and on sponges in tins. Tartar emetic (2 ounces mixed with 1 gallon of water, 1 pound of sugar, and 2 ounces of honey) was more effective than the thallium poisons, although more species of other ants were attracted to the thallium baits because of the higher concentration of sweets used. Counts of the number of active anthills were found not to be a good criterion of the aphid control, and no definite conclusions were drawn. Cotton following corn interplanted with cowpeas or soybeans that serve as late-season hosts for the aphids was much more seriously damaged by aphids than cotton following cotton, tobacco, or small grain.

COTTON LEAF WORM

In 1938 the first report of the cotton leaf worm in the United States came from Port Lavaca, Calhoun County, Tex., on May 2. This was more than a month earlier than the first report in 1937, and was the earliest record in recent years. Leaf worms were reported in various parts of southern and eastern Texas during May and June. The first leaf worm reported from the vicinity of College Station, Tex., was collected on June 18. The worms were found in Madison Parish, La., on July 6. On July 7 full-grown worms were found in Presidio County in the Big Bend section of Texas—a very early date for that section. On July 16 the worms were reported from Garvin County, Okla., Columbia County, Ark., and Holmes County, Miss., and on July 28 from Pima County, Ariz. During August they were

reported from Alabama, Tennessee, and South Carolina, and during September from Georgia, Florida, and Missouri. Although leaf worms reached cottonfields of all cotton-growing States except California in 1938, the infestations were generally rather spotted until late in the season. In the Southeastern States the worms appeared late, the infestations were light, and few growers used control measures. However, in the Delta section of Mississippi and in the States west of the Mississippi River many growers applied arsenical poisons to control the leaf worm. During 1938 the leaf worm moths apparently entered this country from the south only through Texas, the evidence indicating that they did not enter also through Florida as in some years. All the arsenical insecticides used for spraying or dusting plants appear to be effective against the leaf worm. Experiments at Tallulah indicate the value of arsenicals high in water-soluble arsenic pentoxide for use against the leaf worm. There was a direct correlation between the amount of water-soluble arsenic pentoxide in calcium arsenates and their effectiveness in causing mortality of leaf worms. Those highest in water-soluble arsenic pentoxide produced mortality with the smallest doses, and those lowest in water-soluble arsenic pentoxide required the largest doses. The cryolites tested were less effective against the leaf worms than were the calcium arsenates.

VARIETAL RESISTANCE OF COTTON TO INSECTS

Work is being continued at Stoneville, Miss., to secure basic information for use by plant breeders in developing varieties of cotton that may be tolerant or immune to the boll weevil, aphids, and thrips. More than 2,000 species, varieties, and strains of cotton are available for study. From the 44 varieties previously studied, 12 commonly grown varieties were selected, the seeds of which had been self-fertilized for 4 years. Bolls 20 days old collected from each of these varieties which were intermediate in thickness and showed the maximum toughness of carpel lining are being further tested to determine whether this type of boll continues to show the greatest resistance to the boll weevil. From each of these varieties selections have been made of the plants which were determinate in growth, had heavy leaf drop, and maintained light aphid populations. Under natural conditions the plants with the lightest aphid populations have been the poorest in producing fruit. The positive correlation between pilosity of the plants and aphid populations on undusted cotton has been further confirmed. Dusting with calcium arsenate increased the aphid population on all types of cotton. Thrips were most abundant on the pilose cottons, which have large cluster-type buds in which the insects are sheltered.

PINK BOLLWORM CONTROL

The most outstanding developments in the pink bollworm situation for the 1938 crop season were the discovery of a light pink bollworm infestation in the Coastal Bend section of Texas, the finding of reinfestation in the Salt River Valley of Arizona following several years of freedom from infestation, and the disclosure of a heavier infestation in the lower Rio Grande Valley of Texas and Mexico.

INFESTATION IN THE COASTAL BEND AREA

The Coastal Bend quarantine district of Texas includes the counties of Brooks, Kleberg, Jim Wells, Nueces, and the northern half of Kenedy. The first pink bollworm infestation was found in gin trash at Kingsville, in Kleberg County, on July 27, 1938. A proclamation was issued by the Governor declaring these counties a pink bollworm regulated area, and on August 8 an amendment to the State pink boll worm quarantine proclamation was issued by the commissioner of agriculture, establishing rules and regulations governing the movement of cotton and cotton products for the remainder of the season. There was no seed sterilization at gins during the 1938 season because no facilities were available at the time for sterilization of cottonseed; however, gins were required to observe all sanitary measures to prevent the contamination of lint. Seed sterilization was required for outside movement only.

Effective November 17, 1938, Federal Pink Bollworm Quarantine No. 52 was revised to include the counties of Brooks, Jim Wells, Kenedy, Kleberg, and Nueces as part of the lightly infested regulated area. At the end of June practically all ginners in the Coastal Bend district had made definite arrangements for the installation of sterilizers as a continuous process of ginning, and a considerable number of these machines had been installed.

A proclamation was issued by the State of Texas on September 21, 1938, making the destruction of 1938 stalks mandatory and establishing the dead line for completion of such work by October 15. This date was later extended to November 1, however, owing to climatic conditions. At the expiration of this date stalks had been cut in all fields with the exception of 456 acres, most of which was destroyed by December 1. Also, most of the volunteer or stub cotton was destroyed by the end of December. Of the estimated 215,343 acres of 1938 cotton, only 12,054 acres remained unplowed on November 1. In connection with the stalk-destruction program, the State Department of Agriculture found it necessary to file two complaints for noncompliance. Stalks in both these fields were destroyed shortly thereafter.

CONTROL IN THE LOWER RIO GRANDE VALLEY

The fight against the pink bollworm in the lower Rio Grande Valley of Texas and Mexico is considered by the two countries as a common problem. Approximately 260,000 acres were planted to cotton in the four counties involved on the American side and 150,000 in the Mexican regulated area in this valley for the 1938 crop season.

Gin-trash inspections of the 1938 cotton crop in the lower valley area revealed a considerable increase in the degree of infestation over that of the 1937 crop. Consequently, a more vigorous clean-up was planned and carried out during the 1938 crop season. The State of Texas issued an amendment to the stalk-destruction proclamation for that area requiring that all stalks be cut by October 1 and that the plowing up of roots to prevent stub growth be completed by October 15.

On May 1, 1939, one specimen of the pink bollworm was found on a stalk of sprout cotton in a field about 8 miles northwest of Browns-

ville, in Cameron County. Bloom inspection was immediately begun in the 1939 cotton crop, and by June 30, 12 infested fields had been located in Cameron County, and 1,885 specimens of the pink bollworm had been found through bloom and boll inspection, 1,836 of these specimens coming from 2 heavily infested fields. These findings indicated that a much heavier infestation was present in Cameron County in the 1939 crop than existed during the previous season. Considerable inspection of this type gave negative results for the other three regulated counties as of June 30. In the Matamoros district 16 specimens of the pink bollworm were found through bloom inspection during May, but unfavorable weather prevented a sufficient amount of inspection to indicate the degree of infestation in that district.

CONTROL PROGRAM IN THE BIG BEND AREA

Owing to the extremely heavy pink bollworm infestation in the 1937 cotton crop in the Big Bend area of Texas and Mexico, Department of Agriculture authorities of the United States and of Mexico, in cooperation with the State Department of Agriculture, evolved a program, referred to as the "2-year plan," with the objective of materially reducing the pink bollworm infestation in the Presidio-Ojinaga area by the early planting and harvesting of the 1938 cotton crop, followed immediately by the clean-up of fields; delayed planting of the 1939 cotton crop; and the elimination of all stub or volunteer cotton in the spring of 1939 so that no fruit would be available to emerging pink bollworm moths before the maturity of the main cotton crop.

A Texas State proclamation was issued in January 1939 prohibiting the planting of cotton in the affected area until April 20, and a similar proclamation was issued by the Mexican Department of Agriculture for the Ojinaga district. This uniform planting date was observed very closely on both sides of the Rio Grande, as was also the destruction of all stub cotton. It is believed that the spring emergence of pink bollworm moths in that area was practically over by June 10, and no fruit sufficient to maintain and propagate the pink bollworm was found present on cotton plantings before June 17, thus creating a host-free period of several months' duration. Inspection of material from the 1939 crop is awaited with interest.

REINFESTATION IN ARIZONA

In the fall of 1938 an infestation of the pink bollworm was found in the eastern end of the Salt River Valley of Arizona in Maricopa County, in practically the same location where the first pink bollworm infestation was discovered in 1929. Also, a light infestation was again found in the Coolidge district of Pinal County early in November.

As a result of these findings, Federal Quarantine No. 52 was revised effective November 17, 1938, to add to the lightly infested areas in Arizona all of Maricopa County and that part of Pinal County not heretofore within the regulated area. With the additional area involved by these new findings a light general infestation of the pink bollworm extended from Tubac, in Santa Cruz County, northward

to Gilbert, in Maricopa County. Following the discovery of pink bollworm infestation in the 1938 crop, immediately after cotton was picked, early in December, field clean-up operations were begun in the center of the heaviest known infestation, involving 3,100 acres. The Arizona Legislature supplemented the Department fund of $15,000 available for this work with a like amount. The program consisted of cutting, raking, and burning the cotton stalks as soon as the cotton was picked and the plowing of fields to prevent sprouting from the roots and the producing of fruit to propagate and maintain the pink bollworm prior to the fruiting of the 1939 cotton crop. This phase of the program was completed in mid-March.

The completion of these control measures was followed by a spring program, inaugurated on April 10, the objectives of which were as follows: (1) To prevent the growth of all stub cotton, (2) to secure the plowing up of all abandoned cotton fields by April 20, (3) to delay the planting of upland cotton until April 10 and prevent the fruiting of any cotton until June 20. It soon became apparent that some volunteer cotton could not be eliminated from the areas affected, and as the State of Arizona did not have authority to forbid the growing of stub cotton, the assistance of the Agricultural Adjustment Administration was sought. As a result, the A. A. A. issued a regulation on April 29 requiring the destruction of all stub cotton in the area, and this resulted in destruction of 5,210 acres of abandoned volunteer cotton and 288 acres of cultivated stub, nearly all in Pinal County.

Planted cotton was held back by volunteer cooperation among the growers, either by delayed planting, by withholding water, or both. Indications are that prior to June 20 there was no cotton in fruit sufficient to propagate the pink bollworm in Pinal County or in that part of Maricopa County where eradication work was carried on, except in a few isolated plantings.

SITUATION IN OLDER REGULATED AREAS

Gin-trash inspection in the El Paso Valley district during the 1938 season indicated that there was no material change in the status of pink bollworm infestation over the previous season in that district except in lower Hudspeth County, where it was somewhat heavier. Inspections made in the Juarez Valley of Mexico, across the Rio Grande from this district, and also in Vado and Villa Ahumada, Mexico, indicated that infestation in those localities was rather heavy. The Texas Panhandle district was given the most thorough inspection during the 1938 crop season it has had for a number of years. As a result, it was found that the infestation, while very light, was rather well distributed. The greatest number of worms were found in Midland County, where 16 were taken from 482 bushels of trash. One specimen was found in Lamb County, which is the first finding since the county was originally found infested in the 1933 crop. In the Pecos Valley district inspections in Ward, Reeves, and Pecos Counties disclosed a general infestation averaging about 17 worms per bushel. In the Presidio area infestation was somewhat heavier than during the previous year.

A summary of the amount and results of the various types of inspection is given in table 11.

TABLE 11.—*Summary of inspections for the pink bollworm in regulated areas, crop season of 1938*

State and county	District	Gin trash		Field		Laboratory	
		Quantity	Pink bollworms	Man-days	Pink bollworms	Green boll samples	Pink bollworms
Arizona:		*Bushels*	*Number*	*Number*	*Number*	*Number*	*Number*
Graham	Arizona	676	142	0	0	0	0
Maricopa [1]	do	22,485	116	31	6	0	0
Pima [2]	do	2,222	7	0	0	0	0
Pinal [1]	do	5,599	4	0	0	0	0
Santa Cruz [2]	do	54	2	0	0	0	0
Total		31,036	271	31	6	0	0
New Mexico:							
Chaves	El Paso Valley	244	3	0	0	48	0
Dona Ana	do	66	44	0	0	91	1
Eddy	do	145	396	0	0	52	12
Lea	Panhandle	0	0	0	0	32	2
Luna	El Paso Valley	9	137	0	0	24	93
Roosevelt	Panhandle	167	0	0	0	0	0
Total		631	580	0	0	247	108
Texas:							
Brooks [3]	Coastal Bend	68	2	0	0	101	0
Jim Wells [3]	do	1,203	1	0	0	0	0
Kleberg [3]	do	448	5	0	0	0	0
Nueces [3]	do	5,403	5	0	0	0	0
Cameron	Lower Rio Grande Valley	415	324	0	0	0	0
Hidalgo	do	1,103	6	0	0	0	0
Starr	do	230	0	0	0	0	0
Willacy	do	1,161	5	0	0	0	0
Andrews	Panhandle	178	6	0	0	13	0
Bailey	do	669	0	0	0	24	0
Cochran	do	495	2	0	0	0	0
Dawson	do	3,030	4	0	0	0	0
Gaines	do	661	1	0	0	28	0
Hockley	do	2,876	0	0	0	13	0
Howard	do	1,855	2	0	0	28	0
Lamb	do	5,134	1	0	0	0	0
Martin	do	1,198	0	0	0	0	0
Midland	do	482	16	0	0	8	0
Terry	do	2,554	1	0	0	29	0
Pecos	Pecos Valley	66	119	0	0	29	0
Reeves	do	102	2,747	0	0	28	3
Ward	do	103	1,924	0	0	42	6
El Paso	El Paso Valley	31	116	0	0	106	22
Hudspeth	do	43	11,873	0	0	40	0
Total		29,508	17,160	0	0	489	31
Grand total		61,175	18,011	31	6	736	139

[1] Inspections made before Maricopa County and part of Pinal County were brought under regulation.
[2] A total of 603 Thurberia weevils were taken from gin trash examined from Pima and Santa Cruz Counties.
[3] These counties were brought under regulation after inspections were made.

INSPECTION OUTSIDE REGULATED AREAS

Owing to the fact that heavier pink bollworm infestations were found in the 1938 cotton crop in the lower Rio Grande Valley and adjacent Matamoros, Mexico, it was deemed necessary to make a thorough inspection of counties throughout southern Texas. As a result infestation was found in Kleberg, Brooks, Nueces, and Jim Wells Counties, lying in close proximity to the lower Rio Grande Valley, and these counties were later added to the area regulated on account of the pink bollworm. Gin-trash inspection was also carried on in Texas

counties adjacent to the regulated area of the Panhandle district, but no new territory was involved. Intensive gin-trash inspections were made in the southeastern, central, and southwestern parts of Oklahoma, in almost all the cotton-producing counties of Louisiana west of the Mississippi River, and in the Delta counties of Mississippi. Inspections were begun in northern Florida and progressed northward to the central parts of Georgia and Alabama. Results of inspection in all States were negative as to pink bollworm infestation with the exception of Texas. Inspections in the Matamoros section of Mexico, opposite the lower Rio Grande Valley of Texas, revealed a heavy increase in pink bollworm infestation, 15,364 worms being taken from 499 bushels of gin trash, whereas in the 1937 crop the average was slightly less than 2 worms per bushel. At Reynosa, Mexico, 9 pink bollworms were found in 322 bushels of gin trash as against none in the 1937 crop.

A summary of the amount and results of the various kinds of inspection is given in table 12.

TABLE 12.—*Summary of inspections for the pink bollworm outside regulated areas, crop season of 1938*

State	Gin trash		Field		Laboratory	
	Quantity	Pink bollworms	Man-days	Pink bollworms	Samples	Pink bollworms
	Bushels	*Number*	*Number*	*Number*	*Number*	*Number*
Alabama	4,576	0	0	0	0	0
Arizona	315	0	0	0	0	0
California	26	0	0	0	0	0
Florida	1,094	0	66	0	825	0
Georgia	6,179	0	45	0	582	0
Louisiana	4,848	0	0	0	0	0
Mississippi	639	0	0	0	0	0
New Mexico	0	0	0	0	100	0
Oklahoma	7,641	0	0	0	141	0
Texas	54,121	0	6	0	1,510	0
Total	79,439	0	117	0	3,158	0
Mexico:						
Baji California	1,417	0	0	0	0	0
Nuevo Leon	113	0	0	0	0	0
Tamaulipas	938	15,373	0	0	0	0
Total	2,468	15,373	0	0	0	0
Grand total	81,907	15,373	117	0	3,158	0

WILD COTTON ERADICATION

Especially good progress was made in the eradication of wild cotton in southern Florida, the first cleaning being completed in all areas in time to prevent any unusual amount of cotton from maturing seed. There was a decrease of 11,000 wild cotton plants from the number found last season in the Fort Myers district and a decrease of 67,000 in the Keys district. However, there was a small increase of wild cotton plants as a whole in the Ten Thousand Islands section, but a very decided decrease in the number of fruiting plants. The greatest increase was in the Cape Sable section—this being the largest continuous wild cotton area—where 362,000 wild cotton plants were destroyed, or about a 50-percent increase over last season. These facts are very

interesting, in that few or no mature seed have fallen to the ground during the past several years, and all seed that germinated this season must have been from 2 to 7 years old.

During the 1938 season 34,205 acres were covered in southern Florida in the removal of wild cotton plants. Practically all this acreage was gone over twice, and a great portion of it was covered three times. A total of 46,103 plants with mature bolls were found and destroyed and 1,409,438 seedling plants removed. Only 2,043 sprout plants were found during the season.

THURBERIA WEEVIL CONTROL

The area in Arizona now regulated on account of the Thurberia weevil includes Cochise and Santa Cruz Counties and parts of Graham, Pinal, and Pima Counties, this area also being regulated by the pink bollworm quarantine. During the greater part of this year eradication work was carried on in the Santa Catalina Mountains from camps established at various points throughout that mountain range. During the last few months, however, *Thurberia* eradication was carried on in the vicinity of Sahuarita and the Continental ranch in the Santa Cruz Valley and in the large canyons west of the Tucson-Nogales Highway, and laborers have been transported back and forth from Tucson to work. During the fiscal year ended June 30, 1938, 98,020 acres were covered and 444,720 *Thurberia* plants destroyed, bringing the total acreage covered since this work started to 298,170 and the number of plants destroyed to 1,764,762. Funds to carry on this work are provided by Work Projects Administration allotments, together with funds allocated by this Bureau.

BEE CULTURE

In the Bureau's cooperative program on American foulbrood, participated in by the Arkansas, Iowa, Texas, Wisconsin, and Wyoming Agricultural Experiment Stations, over 700 queens of resistant stock were reared by the Texas station during the spring of 1939 for distribution to cooperating beekeepers.

In 1938, when strains of bees were being tested for resistance to American foulbrood at the Bureau's Wyoming laboratory, 27 out of 40 inoculated colonies which contained queens of the F_2 and F_3 generations either recovered or failed to contract the disease, whereas out of 27 colonies headed by 14 queens from stock with an unknown history for disease resistance and 13 from F_1 queens of stock showing resistance only 12 recovered or failed to contract the disease. The data show that an increase in resistance was obtained over that in 1937. Work by the Iowa Agricultural Experiment Station the same year with 111 line-bred queens reared by the Texas station also indicated a gain in resistance. This increase apparently was the result of selective line breeding, although some undesirable characteristics, such as nervousness and a tendency toward irregular-spotted brood nests, seem also to have been intensified.

The Iowa station in 1938 distributed to commercial beekeepers 888 Texas-reared queens of resistant stock. The Bureau's Wyoming station distributed 667 similar queens in Colorado, Minnesota, and Wyoming. Cooperators reported less disease in this stock than in stock obtained from other sources.

Three colonies out of 26 given opportunity in an isolated locality to rob honey contaminated with American foulbrood failed to contract the disease, although the others became infected, in tests on the relation of robbing to spread of the disease carried on by the Wyoming Agricultural Experiment Station. The queens from the three colonies were sent to Texas for breeding purposes.

A new sublaboratory was established on February 1 at Hope, Ark., in cooperation with the Arkansas Agricultural Experiment Station. The long season in southern Arkansas will be used to advantage in supplementing the work on disease resistance. In addition, the program for the laboratory includes maintaining a reservoir of resistant strains and rearing queen bees for testing elsewhere by the Bureau and its cooperating agencies.

That house-cleaning activities of the worker bees play an important part in disease resistance is demonstrated by the large amount of healthy brood reared in cells from which the bees have cleaned out diseased remains. Where reinfection occurs in such cases, infected food rather than remaining diseased material appears to be the cause. The fact that brood from resistant queens showed no less disease than that from nonresistant queens when placed in heavily diseased colonies further points to the importance of the house-cleaning behavior of bees.

The time required for the removal of diseased brood ranges from 1.2 to 10.9 days. The degree of resistance, however, is not entirely correlated with the rapidity of cleaning out the disease. Cells found diseased on one inspection are not likely to be found later if inspections are spaced several days apart. Light infections are thus apt to be overlooked if inspections are made infrequently.

The effect of 8-hydroxyquinoline sulfate at a dilution of 1 to 1,000, added to diluted honey containing spores of *Bacillus larvae* and heated, indicates that small amounts of this substance, insufficient to be toxic to adult bees, greatly diminish the amount of heating necessary to kill the spores. The possibility of the use of this chemical to make such honey safe to feed to bees is thus indicated if it can be obtained cheaply enough.

Inoculations of colonies with spores of *Bacillus larvae* heated in diluted honey for periods of 30 minutes to 5 hours did not produce American foulbrood within 2 years, although spores from the same heated batches grew in culture after 3 to 30 days, showing that while the heated spores did not cause disease in a colony neither were they killed.

A positive nitrite-nitrogen test on a medium containing carrot extract but without added nitrite has long been considered specific for *Bacillus larvae*. Two other spore-bearing bacteria have been found, however, and isolated in pure culture but not identified, which give a nitrite-nitrogen test indistinguishable from that of *B. larvae*.

The relationship of particle size to the toxicity of insecticides to honeybees has been tested for lead arsenate, calcium arsenate, phenothiazine, and cryolite. The median lethal dose for fine cryolite (midsize, 2 microns) was found to be 7.5 micrograms per bee; and for medium cryolite (midsize, 28 microns), 23.2 micrograms. The influence of particle size was of about the same order of magnitude for phenothiazine as for cryolite; for lead arsenate it was much greater,

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and for calcium arsenate it was much less. Of the four insecticides, phenothiazine is by far the least toxic.

Tests of 14 lines of commercial stock in package colonies showed that loss of queens, poor quality or spotted brood, and low honey production were characteristic of certain lines of stock having a common hereditary background. Only 49.3 percent of the queens survived the producing season, and only 27.9 percent of the original number survived as good queens. The average honey yield for the 14 sources of stock ranged from 21 to 162 pounds, while for individual colonies headed by queens that survived the producing season it ranged from 30 to 310 pounds, as compared with the 60 pounds required for winter.

A survey conducted in Wisconsin in 1937 which included the bees of 17 beekeepers possessing a total of 3,438 colonies showed that many of the keepers were losing honey through weak colonies. The average honey crop per colony for the total number in the survey was 125 pounds, while for the colonies of the individual beekeepers the average ranged from 80 to 300 pounds. The range per colony, when only the highest producing colony of each beekeeper is considered, was from 175 to 600 pounds, the average of these colonies being 378 pounds. Since the average crop of the beekeepers as a whole only equaled one-third the average of these maximum-producing colonies, a failure to harvest the major part of the potential honey crop is indicated.

Enough instances of multiple matings of queens were observed at Beltsville, Md., and Baton Rouge, La., to indicate that such occurrences are not so rare as has been commonly supposed.

The followng chemical analysis (percent) of royal jelly was obtained: Water, 66.05; dry matter, 33.95; protein, 12.34; lipid content, 5.46; reducing substance, 12.49; ash, 0.82; undetermined material, 2.84. No demonstrable amounts of vitamin C were found. The absence of vitamins A and E and the presence of vitamin B have previously been reported.

In cooperation with Louisiana State University royal-jelly extracts fed to rats failed to produce any gonadotropic effect, contrary to what has been suggested by other investigators.

In studying the differentiation between workers and queens, chemical analysis shows the queen to have a higher nitrogen, lipid, reducing-substance, and energy content during the developmental period following the time of differentiation than the worker. During the unsealed larval stage the respiratory quotient of both queen and worker is greater than unity, indicating the synthesis of fat from carbohydrates. During the pupal stage the respiratory quotient of the queen ranges from 0.96 to 0.83, whereas that of the worker is between 1.05 and 0.94. Values of less than unity for the respiratory quotient indicate the conversion of fat and protein into carbohydrates or the incomplete oxidation of metabolites.

The optimum temperature for caged bees was found to be 93.9° F. Other optimum conditions for keeping bees in cages, previously found, are a 50-percent sucrose solution, water ad libitum, and a relative humidity of 20 to 25 percent.

Investigations of the causes of mortality during brood development indicate that the nurse bees may be at fault as well as the queen. Thus when eggs from a queen with uniform brood and those of a

queen with spotted brood were interchanged, the eggs from the first queen showed an increase in brood mortality when reared in the other colony, and vice versa.

The need of winter pollen reserves for maintaining spring brood rearing was brought out in studies at Laramie, Wyo., which showed that pollen consumption occurred throughout the winter in colonies with both abundant and negligible pollen reserves but was considerably greater during winter and increased during March and April in colonies with abundant pollen. In colonies with negligible reserves pollen consumption was less in March and April. Abundant pollen reserves are essential if colony population and vitality are to be at a maximum at the beginning of the active season.

Tests on methods of giving colonies additional pollen showed that mixing it in honey or sirup is of little use, since the proventriculus of the bee acts to separate the pollen before the bees can give it to the brood. The tests showed that no brood was reared beyond the larval stage when pollen was given this way exclusively although egg laying was stimulated.

In a study on pollen substitutes, pollenless colonies responded to being given soybean flour by rearing brood for 10 to 14 days, after which they no longer seemed able to mature their brood. Colonies with negligible amounts of pollen responded to the flour by rearing brood normally for at least 4 to 5 weeks. Colonies receiving soybean flour supplemented by either 25 or 50 percent of pollen gave a brood-rearing response equal to that of colonies fed pollen exclusively.

Pollen traps maintained in four California beekeeping areas yielded from 33 to 40 pounds per colony during the year. The daily production varied with the season, forming curves similar to the brood-rearing curves for the areas. As much as one-half pound per day, representing 15,000 loads of pollen, was obtained by a colony during the height of fruit bloom. This shows the great pollenizing value of strong colonies in fruit pollination.

In cooperation with the University of California pollens gathered by bees from 34 different plant sources were analyzed. A wide variation was found in protein and mineral content, as shown by the following summary: Protein, 7 to 35 percent; calcium, 0.3 to 1.18; magnesium, 0.06 to 0.35; phosphorus, 0.11 to 0.81; iron, 0.0006 to 0.0071; and potassium, 0.33 to 1.14 percent.

In studies made in cooperation with the Oregon Agricultural Experiment Station nectar from yellow sweetclover was found to contain more sugar than did that from white sweetclover. In the Imperial Valley of California the quantity of sugar in the nectar of alfalfa was greater for plants grown on dry soils than for those grown on wet soils. In the San Joaquin Valley the nectar secreted by the extrafloral nectaries of cotton was richer than that secreted by the floral nectaries.

The terms of the cooperative agreement under which the Bureau's bee culture sublaboratory was established at Madison, Wis., provide that the Bureau take over practically all the beekeeping work in the State. Operation of the Miller Memorial Beekeeping Library is thus included. With the cooperation of the University of Wisconsin, the collection has been classified by subjects. Cataloging will be done at a future date.

INVESTIGATIONS OF INSECTS AFFECTING MAN AND ANIMALS

SCREWWORMS AND BLOWFLIES

Several new insecticides which are superior to pine-tar oil for protecting animals against infestations by screwworms have been developed. One of these, diphenylamine, although not quite so effective as the others, now appears the most practical for general use because of its availability and relatively low cost, and information on the treatment of animals with this chemical has been released to the public. It has been found that the application of diphenylamine to wounds every third day will prevent them from becoming infested with screwworms and other fly larvae.

Laboratory tests with homologs of benzene as larvicides for the screwworm show that additions of 5 and 10 percent of thiophene and 10 percent of naphthalene to benzene enhance the toxicity of the latter. In undiluted form toluene appears slightly superior to benzene as a larvicide for the screwworm (*Cochliomyia americana* C. and P.), although the use of this material for destroying screwworms has been tried only under laboratory conditions.

Progress has been made in the study of the immunity of mammals to the screwworm. From a large number of tests it was determined that the number of screwworms constituting a maximum sublethal and a minimum lethal initial infestation in the average guinea pig was two and three, respectively, per hectogram of body weight. The maximum enhanced tolerance developed by guinea pigs to *Cochliomyia americana* larvae was found to be approximately 50 to 100 percent greater than that of unifested animals. It was found that this enhanced tolerance was the result of the initial infestation. The tolerance so developed was found to be systemic, but no substance deleterious to the larvae was demonstrated in guinea pigs from as many as four successive infestations. No enhanced tolerance was inherited by guinea pigs born of infested parents.

No immunity to *Cochliomyia americana* larvae was demonstrated by guinea pigs or sheep injected with six doses of vaccines composed of (1) mature tub-reared *C. americana* larvae, (2) mature sterile-cultured *C. americana* larvae, (3) pure cultures of *Proteus chandleri* Sand., an organism commonly associated with screwworms in wounds, (4) trypsin, (5) pepsin, and (6) the fluids in wounds infested with *C. americana* in guinea pigs, sheep, and goats.

Preliminary studies on treatments of sheep and goats with a number of organic chemicals dissolved in benzol indicate that these materials may be of considerable value in the prevention of fleece worm (*Phormia regina* (Meig.)) infestations in sheep and goats. The benzol acts as a larvicide, and upon evaporation leaves a deposit of the chemical on the wool and infested areas to serve as a protector against reinfestation.

In Texas it has been fairly definitely established over a three-season period by cage experiments and trapping surveys that *Cochliomyia americana* overwinters normally in restricted areas south of 30° N. During the coldest years the fly is eradicated from Texas, with the exception of a small area in the lower Rio Grande Valley. The overwintering area in Arizona is normally limited to the low valleys in the southern part of the State. In the Southeast during

a normally mild winter the pest is able to survive as far north as Valdosta, Ga., but during severely cold seasons the overwintering line is about 100 miles south of that locality.

HORN FLIES

The results obtained with an automatically operated fly trap during the second season of tests with this device continue to show its effectiveness in controlling horn flies on dairy and range cattle. On a large ranch near Fort Worth, Tex., the infestation of herds in pastures where these traps were in operation seldom exceeded 150 flies per head, whereas that of herds in circumjacent pastures where no traps were operated was 3,500 to 4,000 flies per animal.

Experiments were continued on the development of a method of controlling horn flies by feeding cattle certain insecticides which pass unabsorbed through the alimentary tract of the animal and render the feces unsuited for the development of horn fly larvae. Feeding phenothiazine at a minimum rate of 22 milligrams per kilogram of body weight was found effective in preventing horn fly development; however, this chemical appears unsuitable for this method of horn fly control since it causes a discoloration of the animal's milk, and continuous feeding or slight overdoses have a tendency to disturb the digestive processes or physical condition of the animal. Another chemical has been discovered which when administered in doses of 8.8 milligrams per kilogram of body weight is as effective as phenothiazine in preventing horn fly breeding and so far has not shown any ill effect on test animals.

CATTLE GRUBS

A practical method has been developed for treating range cattle for cattle grubs. It consists in applying to the backs of the infested animals a wash composed of 12 ounces of derris or cube powder, 4 ounces of soap, and 1 gallon of water. The cattle are run through chutes, and about one-third of a quart of the wash is distributed evenly over the back of each animal and then thoroughly rubbed in with the hands, the application requiring about 2 man-minutes per animal. In the more northern sections better results are obtained if the wash is warmed before the cattle are treated. In the southern parts of the country, where cattle do not carry a very heavy winter coat, about one-third less derris or cube will give almost as good results as the larger quantity.

EXTERNAL PARASITES OF SHEEP, GOATS, AND CATTLE

Continued research on methods of controlling various external insect parasites of animals has shown that a dip consisting of 100 pounds of wettable sulfur plus a wetting agent and 10 pounds of cube or derris powder containing 5 percent of rotenone in 1,000 gallons of water will kill all species of adult lice attacking sheep, goats, and cattle in the United States. This dip will also destroy the adults of the sheep tick, and tests so far indicate that it is effective against horse lice. In connection with the experiments with wettable sulfur, wetting agents have been developed that permit the use of sulfur in alkaline water without causing flocculation.

FLY SPRAYS

As a result of studies for developing more effective insect-killing and repellent sprays, a certain noninsecticidal vegetable oil has been found which, when mixed with pyrethrum sprays, greatly increases the toxicity of the insecticidal principles. The addition of 5 percent of this oil to the spray effectively prevents recovery of houseflies, even from light doses of pyrethrum. For household sprays the quantity of pyrethrum necessary to produce a satisfactory kill of flies can be cut in half when 10 percent of the oil is added, but the action of such a dilute spray is too slow to be satisfactory for use under more or less open conditions such as dairy barns. It was found that the oil increases the repellent action of pyrethrum sprays and enhances the efficacy of water emulsions of pyrethrum extract. A patent covering the free use of this material by the public has been applied for.

MOSQUITOES

Steady progress has been made in studying the habits and biology of the 23 species of mosquitoes in the Pacific Northwest. These numerous pest species have been grouped in 7 or 8 general associations so that practical information on mosquitoes and their control can be given the public. The classification of mosquito-breeding areas in this way as a result of surveys has been a distinct aid to mosquito-control agencies, since the mosquito problems vary greatly in the several physiogeographical areas of the Northwest. Two rather distinct and unique methods of control have been developed, (1) the destruction of the habitat of the floodwater species *Aedes vexans* (Meig.) and *A. aldrichi* D. and K. by clearing out the brush where the eggs have been deposited, and (2) control of the snow-water species *A. aboriginis* Dyar, *A. hexodontus* Dyar, *A. fitchii* F. and Y., and *A. communis* D. and G. by maintenance of water levels. There are certain limits in the application of these methods, but each is effective where it can be applied, and without undue injury to wildlife and fish. Definite information is obtained each year on the longevity and viability of the eggs of the first two species.

A comprehensive study of the effects of the Bonneville Dam on the mosquito population reveals that the impoundment of water by the dam has actually caused a decrease in the population of the important floodwater species above the dam from Bonneville to The Dalles, a distance of 50 miles.

Investigations of sald-marsh areas in Delaware and New Jersey, where extensive mosquito-control operations are under way, to determine the effect of ditching on marsh conditions, indicate (1) that changes in the flora and fauna of the marshes depend largely on the extent to which the water table is lowered, (2) that drastic lowering of the water table is not essential to effective mosquito control, and (3) that control measures should be adapted to meet individual conditions in each area.

In view of the importance of salt-marsh mosquitoes, a field laboratory was established at New Smyrna, Fla., to initiate detailed studies on their biology, habits, and control. It is expected that emphasis will be placed on developing more satisfactory control measures than

have been available heretofore and measures that will not affect the marshes as habitats of wildlife.

Intensive studies are under way to develop mosquito larvicides that are not only more effective but also nontoxic to birds, fishes, and plant life. Research thus far indicates that phenothiazine and a few other organic chemicals are promising in this respect.

CLEAR LAKE GNAT

Nonbiting midges of the genus *Chaoborus* which breed in enormous numbers in certain bodies of fresh water are a source of great annoyance to nearby residents and visitors to resorts in a number of localities in the United States. To determine methods of controlling them a field laboratory was established at Nice, Calif., on Clear Lake, where these insects are unusually abundant. Since relatively little is known of the biology of the gnats, considerable work has been necessary to determine their rather intricate life histories and their relationship to environmental factors. Preliminary studies have been made also to determine the value of various biological, chemical, and mechanical methods of destroying the gnats, but thus far nothing practical has been developed.

INSECT SECRETIONS

Extended research into the physiology of insect secretions has developed the fact that blowfly larvae cause the production of ammonia in the material upon which they are feeding. This ammonia production appears closely associated with the healing effects of surgical maggots and with the attractiveness of screwworm-infested wounds in animals. Up to the time of these investigations no definite evidence had been presented showing how the larvae produced ammonia. It has now been discovered that the maggots secrete the enzyme urease, and this, acting on the urea present in the tissues of larvae as well as of the wound, causes the formation of ammonium carbonate and ammonium bicarbonate. These materials have been found to have a stimulating effect on the healing of obstinate lesions.

TICKS AFFECTING MAN

Investigations have been continued on methods of controlling the American dog tick, which transmits Rocky Mountain spotted fever in the East. A dip or wash composed of derris (containing 3 percent of rotenone), neutral soap, and water has been found effective in preventing complete engorgement of female ticks on dogs. If dogs are treated twice a week with this material, no reproduction of the ticks occurs. Tests are under way to determine the feasibility of systematically dipping all dogs in a given area for elimination of the ticks. Experiments are also being carried on to determine whether the destruction of meadow mice, the principal hosts of the immature stages of the tick, will eradicate the ticks in limited areas.

HOUSEHOLD AND STORED-PRODUCT INSECTS

Investigation of a number of organic chemicals as possible mothproofing agents shows encouraging results with one or two com-

pounds, and further studies of these and new substances are being made.

In addition to handling a tremendous volume of correspondence relating to the control of household and stored-product pests, cooperation was extended to a number of commissaries of Federal establishments, such as the Procurement Division of the Treasury Department, and wholesale and retail grocers and confectioners, by giving them advice as to methods for ridding food commodities of insect infestation or protecting them from infestation, or by supervising the application of such methods.

Observations have been made on how some of the common packaged foods become infested. These studies indicate that when an insect-free commodity is thoroughly sealed in a clean cardboard carton, especially of the cylindrical type, it remains free from insect attack indefinitely, provided the seal or package is unbroken. Foods in rectangular cardboard cartons appear more likely to become infested than those in cylindrical ones, owing to the difficulty of making an impervious seal.

INSECT IDENTIFICATION

A total of 60,117 identifications were made and reported, in addition to approximately 4,000 that were required in connection with the white-fringed beetle survey conducted in the Southern States. About 70 percent of the determinations made were for the various research and regulatory units of this Bureau, including the Division of Foreign Plant Quarantines, and for other Federal organizations; about 15 percent were for agencies of the various States and the insular possessions; and the remainder were for individuals in the United States and for foreign institutions and individuals. Other service activities of the Division included assistance to numerous outside investigators on problems involving insect taxonomy, nomenclature, morphology, species distribution, and host relations; also the arrangement of 134 loans of insect material, comprising approximately 13,000 specimens selected from the reference collections by the specialists of the Division, and the review of 80 manuscripts for checking the accuracy of scientific names.

The extensive insect collections that are essential for the conduct of identification work have been maintained in good order and numerous subdivisions rearranged in accordance with recent revisions of the classification, thus facilitating the making of identifications in those groups. Numerous important additions, a total of more than 70,000 specimens, have been made to these collections during the year.

On an average, the 27 specialists of the Division could devote approximately only 20 percent of their time to research, owing to the large volume of service demands. Nevertheless, 52 manuscripts were completed and submitted for publication. These consisted in part of short papers prepared to supply authentic names required for use in biological and control studies conducted elsewhere in the Bureau or by outside agencies, but included also monographic papers, on some of which work had been in progress for several years. Among the latter are comprehensive taxonomic treatments of the following: *Chirothrips*, a genus of thrips; *Pantomorus*, the group containing the

white-fringed beetle; *Exenterus*, a genus of parasites of injurious sawflies; the moth family Oecophoridae; *Myzus*, an important genus of aphids; and *Osmia*, a large group of bees. Definite progress was also made on a considerable number of research projects that were not completed during the year, including a generic revision of the North American thrips, a study of the American thrips belonging to the genera *Thrips* and *Frankliniella*, revision of the weevil genus *Rhyncolus*, classification of the buprestid beetles making up the tribe Chrysobothrini, revisional studies of the bark beetles of the genera *Hylastes* and *Pseudohylesinus*, classification of the white grubs or larvae of the genus *Phyllophaga*, revision of the geometrid moths of the genus *Ellopia*, studies on the American Phycitinae, monograph of the blowflies of North America, revision of the fruitflies of the genus *Anastrepha*, revision of the North American wasps belonging to the genus *Trypoxylon*, studies in the classification of male ants, revision of the carpenter ants belonging to the genus *Camponotus*, generic revision of the family Cicadellidae (leafhoppers), a study of the true bugs making up the family Lygaeidae, review of the aphid genus *Kakimia*, revision of the grasshoppers of the genus *Orphulella*, a study of the order Protura, generic classification of the North American fleas, revisions of the scale insects belonging to the genera *Asterolecanium* and *Cerococcus*, and a study of the male genitalia of the Hymenoptera.

FOREIGN PARASITE INTRODUCTION

The foreign work of parasite introduction, centering largely at the field stations at St. Cloud, France, and Yokohama, Japan, has continued on the same series of crop pests as indicated last year, to which has been added the asparagus beetle and the pea moth in Europe and the white-fringed beetle in South America.

PARASITES OF CEREAL AND FORAGE INSECTS

Continued attention was given to securing parasites of the hessian fly, the vetch bruchid, and the European corn borer. Of hessian fly parasites, 2 shipments of *Trichacis remulus* (Walk.), totalling 518 adults, were made. A new and promising area for parasite collection was found in Morocco, where the infestation is heavier than in France and parasites are much more numerous. Stem infestation averaged about 67 percent during 1938 and parasitization ranged up to 76 percent, as contrasted with a very low percentage in France. The particular value of Moroccan parasites is the apparent readiness with which they attack the fall generation. Two new and promising species were secured from the Morocco material.

Vetch bruchid parasite material imported from France during the year consisted of 39,550 host eggs which had been exposed to *Triaspis thoracicus* (Curt.) and 2,776 adults of a new larval parasite, *Tetrastichus* sp. A total of 1,124 adults of *Triaspis* were shipped to North Carolina for early colonization during May and June.

Work on European corn borer parasites was restricted to the securing of *Phaeogenes nigridens* Wesm. from Italy. A total of 8,322 adults and 5,720 parasitized host pupae were forwarded during August.

During the period from September 1938 to April 1939 a survey was made of the white-fringed beetle in Argentina, Uruguay, and southern Brazil. In the first two countries the beetle was found generally, though not in sufficient abundance to cause injury to crops, but its range does not extend into the subtropical sections of southern Brazil. Damage by any species of *Pantomorus* (*Naupactus*) is limited very largely to relatively small patches in alfalfa fields, and the infestations do not persist from year to year. An extended search was made for natural enemies but no trace of these was found.

PARASITES OF COTTON INSECTS

The bulk of the pink bollworm parasite material imported from Japan and Chosen during the spring of 1938 was held in storage until August, at which time 72,000 cocoons of *Microbracon nigrorufum* Cushm. were forwarded to the Presidio, Tex., station of the Division of Cotton Insect Investigations. An additional quantity of 21,481 cocoons was held at the receiving station and the adults were forwarded. A total emergence of 59,500 was secured from the 2 lots.

PARASITES OF FOREST INSECTS

Activities in the field of forest-insect parasites consisted of an extended survey and study of the European spruce sawfly in northern Europe. The more extensive studies were made in Sweden, Finland, Lithuania, Latvia, and Estonia. The pest was found to be common, and abundant in restricted localities, throughout the range of spruce growth, this extending above the Arctic Circle in Sweden. Parasitization was found to be higher than in central Europe, ranging from 10 to 60 percent, the highest being in Estonia. This work is carried on in cooperation with the Canadian Department of Agriculture, which undertakes the large-scale collection and importation of material on the basis of information made available through the survey. From material imported in 1938 that Department shipped to the Bureau station a total of 12,968 adults of 2 species of *Exenterus*, as well as rearing stocks of *Microplectron* to State organizations.

PARASITES OF FRUIT INSECTS

Investigations in Japan and Chosen have been limited largely to a determination of the alternate hosts of the different parasite species attacking the oriental fruit moth which have been imported into the United States in past years. A number of the more important species have alternate hosts within which they pass the winter, and this habit may explain the difficulty in securing their permanent establishment in the United States. In February a shipment of 154 adults of *Phaeogenes haeussleri* Uch. and approximately 17,000 host cocoons containing larvae previously exposed to this parasite in the insectary was forwarded.

PARASITES OF TRUCK CROP INSECTS

Work upon lima bean pod borer parasites in France was continued on a reduced scale. Shipments totalling 12,223 *Phanerotoma planifrons* (Nees), 1,535 *Microbracon pectoralis* Wesm., 759 *M. piger* Wesm., and 1,082 of two minor species were made to California dur-

ing the latter part of 1938, and 483 adult *Chelonus* sp., with 1,800 parasitized host larvae, in the spring of 1939.

A new activity of the European station is the collection and shipment of *Meigenia floralis* Meig., a parasite of the asparagus beetle which is effective in France. The first shipment, consisting of 497 puparia and 4,800 parasitized larvae, was made in June.

One consignment of 153 puparia of the European earwig parasite *Rhacodineura antiqua* Fall. was forwarded to the Puyallup, Wash., station to serve as a rearing stock for domestic production.

A survey of the status of the pea moth was started in France during the year to determine if natural enemies play an important part in its control.

EFFECT OF CHEMICAL CONTROL METHODS ON POPULATION OF NATURAL ENEMIES

The major activities under this project have been concerned with the codling moth at Kearneysville, W. Va., the citrus scales and whiteflies at Orlando, Fla., and the citrus scales and red mites in southern California. The codling moth experiment which is carried on in cooperation with the Division of Fruit Insect Investigations and the West Virginia Agricultural Experiment Station has shown for the third year that the production of clean fruit is approximately equal in sprayed and unsprayed orchards. The factors responsible for this condition have not yet been fully determined, but predacious ants appear to be one of the most important.

In the case of the fungus diseases of scale insects and whiteflies in Florida, it has been found that the fungi are of very little value in control and that fungicides can be applied for the control of citrus diseases without regard to the effect upon the forms parasitic upon insects. An improved sampling technique has been developed which appreciably reduces the time and labor involved in experimental work on this problem.

The investigation on citrus insects and mites in California has shown, in the case of the black scale, that groves in certain sections may be left untreated without the development of a serious infestation, while if fumigation or spraying is started in such groves the population of natural enemies is reduced and the treatments must consequently be continued. The heavy red mite infestation during recent years in southern California is correlated with the more general adoption of oil sprays against the scale insects, and where such treatment can be avoided the injury by red mites is much reduced. A mechanical device was developed for use in sampling experimental plots, and this permits of 200 trees being adequately sampled in 3 or 4 days.

COOPERATIVE WORK WITH PUERTO RICO

The cooperative work with the Puerto Rico Agricultural Experiment Station of the Office of Experiment Stations has been continued, and the Division has provided directly, or through other Divisions of the Bureau, for the shipment to the island of five species of parasites of the lima bean pod borer from France, one pink bollworm parasite from Japan, and one parasite of the sugarcane borer from the United States.

Shipments to the United States from the Puerto Rico station comprised a rearing stock of the Sao Paulo strain of the Amazon fly (*Metagonistylum minense* Towns.), a promising parasite of the sugarcane borer, and the following beetle predators of the coconut scale: 120 *Cryptognatha nodiceps* Mshll., 600 *Pentilia castanea* Muls., and 225 *Pentilia* sp.

COOPERATION WITH FOREIGN ORGANIZATIONS

In addition to the cooperative work with the Canadian Department of Agriculture, already mentioned, colonies of parasites have been forwarded to foreign countries by this or other Divisions of the Bureau as listed in table 13.

TABLE 13.—*Shipments of parasites to foreign countries, fiscal year 1939*

Country	Host	Parasite
Canada	Citrus mealybug	*Pseudococcobius terryi* How.
Cuba	White peach scale	*Prospaltella berlesei* How.
Mexico	Citrus blackfly	*Eretmocerus sereus* Silv.
	Cottony cushion scale	*Rodolia cardinalis* Muls.
	Pink bollworm	*Microbracon nigrorufum* Cush.
	do	*Chelonus blackburni* Cam.
New Zealand	Cabbageworm	*Apanteles glomeratus* L.
Santo Domingo	Mealybugs	*Cryptolaemus montrouzieri* Muls.

CONTROL INVESTIGATIONS

TESTING INSECTICIDES

The work on testing insecticides was continued as in previous years except that many more tests were made with a larger number of insects. In testing organic compounds 10 materials were found which showed sufficient promise to warrant intensive study. All these when used as stomach insecticides caused high mortality to well-grown larvae of 3 or more species of insect pests. Some of these compounds may be of value in the commercial control of various insects.

In cooperation with the Division of Drug and Related Plants of the Bureau of Plant Industry approximately 600 preparations of rotenone-bearing plants and 72 preparations from plants producing pyrethrum, grown in the United States, were tested by biological assay to determine their insecticidal value. The results of this work are promising and indicate that it is possible by selection to obtain strains of plants with considerably higher insecticidal value.

The effect of the diet of certain insects on their susceptibility to poisons was investigated, and it was found to have a marked influence on the toxicity of some of the common insecticides, such as arsenicals. For example, larvae of the southern armyworm reared on pokeweed leaves were practically immune to dosages of lead arsenate which killed 95 percent of the individuals reared on young collards. Studies of household sprays on houseflies showed that flies temporarily paralyzed by the sprays were more resistant than the normally active flies. Four reports were prepared, mimeographed, and distributed making available the results of approximately 4,000 tests on 800 different materials made on about 21 species of insects. Preliminary results were obtained in tests with the more promising of these materials to determine their effect on the host plants.

FUMIGATION INVESTIGATIONS

The work on fumigation of nursery stock for the oriental fruit moth with methyl bromide was continued. Several of the Western States amended their quarantines so that treatment with this fumigant as found to be effective was approved as a condition for entry. One nursery fumigated and shipped 465 orders into these Western States during the year, a total of approximately 11,000 plants. It was shown in the investigational work during the 1938–39 season that a dosage of 2 pounds of methyl bromide for a period of 4 hours at 70° F. was effective in destroying all stages of this insect, and this modification of the usual treatment has been recommended, since there is less danger of injury to the plants with this lower dosage.

Fumigation with methyl bromide has been adopted quite generally throughout the quarantine-regulated area for treatment of produce in carlots to destroy the adult Japanese beetle. In continuing the investigational work, it was shown that it was possible to reduce the dosage of methyl bromide required at the higher temperatures and still kill all the Japanese beetles in carloads of produce. This will reduce the cost of the fumigant about 20 percent.

Investigations on the fumigation of nursery stock with methyl bromide for the larvae or immature stages of the Japanese beetle were carried on. They involved the fumigation and treatment of several thousand plants of 503 varieties and 187 genera to determine the effect of the treatment on the plants. It was found possible to obtain complete mortality of the Japanese beetle larvae in soil about the roots without injury to most types of nursery stock. The treatment is limited at present to soil masses 8 inches in least diameter and to bare-rooted nursery stock. Approximately 300,000 plants were treated for the Japanese beetle by this method.

A fumigant comprising a mixture of hydrocyanic acid and methyl bromide was developed. This is apparently much more toxic to the Japanese beetle adults than either one of the components in comparable concentrations.

Methods for the control of the white-fringed beetle (*Pantomorus leucoloma* (Boh.)) by fumigation of balled nursery stock with methyl bromide were developed, and about 10,000 plants were treated. This treatment is limited to nursery stock in soil masses not more than 3 inches in diameter. A method of fumigating potting soil with methyl bromide for this insect was also worked out, and treatment of soil about nursery stock with a solution of methyl bromide and alcohol in water was tested and proved effective.

Fumigation of sweetpotatoes with methyl bromide for the sweetpotato weevil was applied to about 2,000 bushels of seed sweetpotatoes with excellent results. Further work with sweetpotato plants showed that they can be freed readily from all stages of the sweetpotato weevil without injury by fumigation with methyl bromide.

Studies on the development of treatments for plants imported into this country were continued, and dosages of methyl bromide necessary to destroy all stages of mealybugs, red spiders, Cattleya leaf miners, active cockroaches, larvae of acorn weevils, bean pod borers, and a number of other insects were obtained. Treatment for *Maruca testulalis* (Geyer), a bean-pod borer, was worked out on a commercial

basis, and some 11,590 hampers of green lima beans and 97 crates of pigeonpeas were fumigated for this insect without damage to the commodity. A total of 9,575 cases of cipollini bulbs were also fumigated experimentally for larvae of *Exosoma lusitanica* (L.), with complete mortality of the insect and no injury to the bulbs. Comprehensive trials of 29 varieties of dormant deciduous woody perennials indicated that with one exception they were tolerant to methyl bromide at rather high dosages. Treatment of *Cattleya* orchids by fumigation with methyl bromide for the destruction of the Cattleya leaf miner indicates that this method might be used for this purpose, as orchids fumigated over a year ago are in excellent condition. Further work on this is necessary, however.

PHYSIOLOGY OF INSECTS

In the studies on the physiology of insects, work was continued on the formation and function of glycogen in the blood of insects. Glycogen is found in the eggs of the southern armyworm but is not found in the blood cells of the newly hatched larvae and was found rarely in first-instar larvae. It is commonly found in the later instars, being present in more cells the greater the instar. Starvation decreases and glucose injection increases the blood-cell glycogen. Both the blood-cell forms and the blood-cell glycogen were markedly affected by certain poisons, such as arsenicals, and only slightly or not at all by other poisons.

With arsenicals, however, the death of the insects seems to be due to a disintegration of the epithelial cells of the alimentary canal, and it is now known that preliminary phases of disintegration begin shortly after the poison reaches the tissues of the digestic tract and that the extent of the injury progresses from then until the lethal action is completed.

HEAT TREATMENT OF FRUIT

In connection with change in quarantine regulations which provided for the certification of Hawaiian-grown fruits and vegetables to the United States, subject to prescribed sterilization treatments at approved plants, investigational work was taken up to determine the tolerance of such commodities, particularly papayas, to the treatment required. This was necessary before a process could be developed which satisfied quarantine requirements and at the same time occasioned minimum injury to the fruit. The installation of equipment for applying the heat treatment and the testing of it were supervised. In cooperation with the Hawaiian Agricultural Experiment Station, studies were carried on in developing a satisfactory high-temperature treatment for papayas and the establishment of movements of this fruit on a commercial basis.

APPLICATION OF INSECTICIDES

The project for developing more effective methods of applying insecticides was advanced considerably this last year by the acquisition of an autogiro. This machine was equipped with an insecticide distributor of a design developed as a result of studies extending over several years. Initial tests of the aircraft and apparatus were inter-

rupted by severe damage to the autogiro during the New England hurricane of September 1938. Reconditioning of the aircraft and completion of tests in the spring of 1939 permitted actual field use of the equipment in June of the same year for treating an area near Greenfield, Mass., infested with the gypsy moth. Although the area treated presented unusual difficulties from the viewpoint of applying insecticides by means of a plane, the autogiro and the distributing apparatus operated successfully and without mechanical failure of any kind. The operations demonstrated that it was feasible to use rotary-winged aircraft over hilly, heavily wooded terrain, and that the method used in dispersing and distributing the insecticide was sound in principle.

INSECTICIDE INVESTIGATIONS

Efforts were continued to develop new and more effective insecticides. Many of the results were made available to the public by means of 58 scientific papers, comprising 1 technical bulletin, 10 articles in the Bureau's E series, 1 in the ET series, and 46 articles in technical and trade journals. Ten patents were issued to members of the Division, and the monthly review of United States patents relating to pest control was issued regularly and distributed to a large number of foreign and American entomologists.

CHEMICAL INVESTIGATIONS ON INSECTICIDAL PLANTS (TOBACCO, DERRIS, PYRETHRUM, ETC.) AND THEIR CONSTITUENTS

Investigations of pyrethrum narrowed down to an intensive study of the one still unknown feature of the nature of the two insecticidal pyrethrins it contains, namely, the exact structure of the side chain of the alcohol pyrethrolone. The latter has long been suspected to contain an allene grouping. During the year two compounds containing allene groupings were successfully synthesized, and bromine was found to react with them similarly to the way in which it does with pyrethrone. Final and direct confirmation will be sought by isolating one of the products of the bromine reaction and preparing from it a substituted caproic acid whose structure is known.

The work with rotenone-bearing plants was particularly characterized by a renewed intensive study of derris and cube resins, with special attention to deguelin because all available information indicates it to be the next most important compound. Deguelin is believed to exist in the resin in an optically active form, but no active crystalline material has ever been obtained, the deguelin heretofore available being the inactive form obtainable only after treatment of the resin with mild alkalies, which evidently racemizes it. The attempt to separate ordinary deguelin into its two optical components failed, but led to the discovery that it makes numerous complexes with various organic liquids, one of which, that formed with carbon tetrachloride, became the basis of a new method of estimating the quantity of deguelin present in a root or resin. High-vacuum distillation permitted the preparation of a solid substance containing over 80 percent of optically active deguelin, but even this could not be made to crystallize and yield the pure compound. The concentrated material has shown insecticidal effects of the same general intensity as those produced by rotenone.

The work with nicotine and tobacco took mostly an analytical turn. A new and delicate colorimetric method was devised which permits the determination of the nicotine on an individual sprayed apple, and is proving of great benefit in studying the various spray schedules that continue to show the value of the tank-mix nicotine-bentonite in controlling the codling moth. A variation of the method was developed which will permit at least a rough measurement of the nicotine content of a leaf selected from a growing tobacco plant, and is being used by the Bureau of Plant Industry in the study of the nicotine-producing power of hybrids and crosses of the tobacco plant.

The fruit of the Amur cork tree (*Phellodendron amurense*) having previously been found to contain an insecticidal principle, a detailed investigation of it was begun. Its stability toward alkali shows that it is quite different from either the pyrethrins or rotenone, and the absence of nitrogen proves that it is not an alkaloid.

CHEMICAL INVESTIGATIONS TO DEVELOP SYNTHETIC ORGANIC INSECTICIDES

The Division continued its search for synthetic organic insecticides, preparing several hundred compounds and submitting them to regular testing services supported by several other divisions of the Bureau. Those showing any marked insecticidal efficacy were made the subject of patent applications to guarantee their free use to the public; two such patents were secured.

Phenothiazine received further laboratory attention. Search for suitable stickers to use with it was continued, and the fact that it decomposes more rapidly in mixture with some accessory materials was noted; it was definitely recognized that fine subdivision of the material increases both its adherence to foliage and its toxicity to insects, and a study of its volatility was begun. A review of the literature concerning the rate of evaporation of slightly volatile substances led to the belief that phenothiazine may disappear by volatilization. The vapor pressure-versus-temperature curve of the compound has been determined, and actual evaporation studies are now under way.

Renewed attention was given to phenazine, for which no simple method of preparation has been known. Two new methods of synthesis have been devised, and its economical production by one or both of these is being further studied.

New compounds are regularly tested now against larvae of the screwworm fly, and during the year the toxicity of about 500 materials of known structure was studied. Hopes of finding enough structural relationship between active compounds to permit formulation of a working theory of toxic groups were not realized.

CHEMICAL INVESTIGATIONS OF SPRAY RESIDUES AND THEIR REMOVAL

The Yakima laboratory took part in its usual fruit-washing program in cooperation with the Bureau of Plant Industry. All lead residues were reduced below the new tolerance of 0.025 grain of lead per pound, loads as high as 0.190 grain per pound being reduced satisfactorily by even the single-process machine. All fluorine residues except one were cleaned well below the new tolerance of 0.020 grain of fluorine per pound. At Vincennes residues of arsenic, nicotine, and phenothiazine

were determined at intervals in all spray plots containing them to correlate the amount of residue with insecticidal potency. Distribution studies such as were formerly made with lead arsenate were made for nicotine-bentonite and phenothiazine, and much the same results obtained for the variances due to trees, parts of trees, and individual apples. An extensive study was made of residues from the use of calcium arsenate and of paris green on tomatoes. Immediately after the last application of undiluted calcium arsenate the tomatoes showed residues exceeding the tolerance, but these were easily removed by washing or wiping.

Articles were published on the removal of residues of phenothiazine and of nicotine-bentonite from apples. A very important digest and bibliography of the literature concerning insecticidal spray residues was issued during the year.

CHEMICAL INVESTIGATIONS TO DEVELOP INORGANIC INSECTICIDES

Articles were published concerning a method of making calcium arsenate of low solubility; a review of the uses of fluorine compounds as insecticides was issued; and a bibliography of all information on magnesium arsenate was published.

A study was begun of the use of sodium arsenite and white arsenic in the control of the Mormon cricket. Present practice calls for dusting the crickets with a mixture of sodium arsenite and diatomaceous earth, but there are some objections to this mixture. By a combination of laboratory and field work it was determined that the white, pure form of sodium arsenite now being used could be replaced by another commercially available gray, impure form with considerable saving in cost; that the poison as now produced is too coarse and the diluent too fine for the best results; and that white arsenic, at least in the forms now available, is not toxic enough to the crickets to be substituted for the sodium arsenite. The work will be continued to find out whether the sodium arsenite is being used at the optimum composition and concentration.

CHEMICAL INVESTIGATIONS OF FUMIGANTS FOR CONTROL OF INSECT PESTS

The work at Whittier, Calif., continued to deal with controlled dosage fumigation of lemons infested with the California red scale, in continuation of the effort to develop a set of experimental conditions so exactly reproducible that the effects due to differences in susceptibilities of insects, protective stupefaction, etc., can be more clearly demonstrated and measured. In addition, a study was made of the possibility of using methyl bromide against this scale. It was found that there was little difference in the susceptibility of the early gray adult insects from resistant and nonresistant strains, when compared either by means of various concentrations for a fixed exposure or at various exposures for a fixed concentration. The so-called resistant strain (i. e., to hydrocyanic acid) shows more resistance, however, when the oldest adults are tested. It seems also as if low temperature reduces the toxic effect of methyl bromide, which is contrary to the results with hydrocyanic acid. All the tests seem to indicate that methyl bromide is not very promising for use against

the California red scale in quarantine work, because of the high concentrations necessary to give a complete kill. Even at the rate of 7.5 pounds per 1,000 cubic feet there were occasional survivors in some stages. This work also gave an opportunity for studying the effect of methyl bromide on late pupae and unemerged adults of a parasite (*Comperiella bifasciata* Howard) of the yellow scale, and pupae of a predator (*Conwentzia hageni* Banks) of the citrus red mite.

CHEMICAL INVESTIGATIONS ON ACCESSORY MATERIALS FOR USE WITH INSECTICIDES

Studies were made of the effect, upon the wetting and spreading power of a commercial wetter, of the addition of calcium and magnesium salts, simulating its use in hard water. A relationship was demonstrated between the wetting power of spray solutions, as determined by the standard method used in the Division, and the initial retention of the solution by a sprayed fruit surface.

The intensive search for stickers for nicotine-peat and phenothiazine was brought practically to a close, without any very striking results. Of the nine stickers used with nicotine-peat, bentonite proved to be the only all-around satisfactory one when items of cost, availability, convenience, etc., were considered along with its actual performance. In the work with phenothiazine attention was paid not only to plain stickers, but also to antioxidants, in the belief that some of the lack of persistence is to be charged to decomposition rather than to mechanical loss. Many of the accessory materials hasten the decomposition, and the phytocidal action of any heavy deposits produced and maintained may offset considerably any insecticidal improvement. Short cellulose fibers from hemlock were given a trial, but were not particularly effective.

Much work was devoted to accessories for use with the tank-mix nicotine bentonite which is proving so successful against the codling moth. Its compatibility, as judged by maintenance of insoluble nicotine, with soaps, wetting agents, oils, copper fungicides, and lime-sulfur was studied, and it was found that any material with a marked alkaline reaction liberated the nicotine and hence may be judged incompatible. Variations in formula did not lead to any improvement over the already adopted formula for the nicotine bentonite.

A study was made of adjuncts for use with the standard Japanese beetle bait as a possible means of improving the attractiveness of the geraniol to last throughout the season. The value of antioxidants was explored, and it appears that basic substances are definitely barred, but that acids such as citric, acetic, and phthalic may have some value. The possibility of substituting thymol, safrol, phenol, and other similar materials for the eugenol commonly employed is also being studied.

The question of the suitability of diluents for use with powdered insecticides was brought to the fore by the investigation which was started in conjunction with Mormon cricket control. Numerous commercially available diluents were tested as to particle size and as to their tendency to separate from mixtures with sodium arsenite and white arsenic when blown from a dust gun, and indications obtained that there are probably more suitable ones than the diatomaceous earth now used.

Field trials in search of materials capable of aiding in the removal of lead arsenate from the grass on plots of ground to which it is applied for controlling Japanese beetle larvae demonstrated that a certain proprietary wetting agent when incorporated with the wash water normally used produced a decided benefit in this respect.

TESTS TO DETERMINE THE TOXICITY OF NEW INSECTICIDAL COMPOUNDS TO GOLDFISH

Efforts were continued to ascertain, by means of tests against goldfish, the correlation between toxicity of compounds and the chemical groupings they contain, so that the hunt for organic insecticides might be more intelligently guided. The work on the monosubstituted phenols was greatly advanced by a completion of the comparison of the isomeric chlorophenols, bromophenols, and iodophenols. The superiority of the iodine compounds over those containing chlorine or bromine and the general superiority of the para-substituted compound in each isomeric group was demonstrated. Work is now under way with the hydroxybenzoic acids.

All such work as this has been heretofore carried out at 27° C., but it has gradually become apparent that other temperatures might be more suitable for some tests; hence an investigation was begun of the temperature-mortality relationship in the case of goldfish exposed to the effects of rotenone and phenol, the two standard comparison materials now used. The importance of temperature control is readily appreciated in view of the fact that the survival time in solutions of either of these poisons is only about one-fourth as long at 27° as at 7°.

ANALYTICAL INVESTIGATIONS

The routine analytical work of the Division embraced, as usual, the analysis of several hundred samples of experimental insecticides being tested by other divisions of the Bureau and also nearly 500 samples of soil containing lead arsenate from the areas quarantined by the Division of Japanese Beetle Control.

As usual during the last several years, the collaborative work on the determination of minute amounts of arsenic in foods was conducted for the Association of Official Agricultural Chemists by the member of the Division who acts as referee on that subject. One of the three new methods mentioned in last year's report as having been developed by him was completely worked out and is under collaborative test this year; it is a titration method as delicate and as speedy as the Gutzeit method and decidedly more flexible and accurate. It appears certain to displace that time-honored procedure.

One of the several new procedures for determining residues of nicotine on sprayed fruit and foliage, namely, the colorimetric procedure using cyanogen bromide and α-naphthylamine, was also developed to a very satisfactory state, and, as it can be used in estimating the nicotine on a single apple, it is now making possible a detailed study of variability of nicotine residues such as was carried out for lead arsenate several years ago.

The colorimetric procedure developed in the Division previously for the determination of phenothiazine in spray residues was improved by adding a preliminary extraction with petroleum ether, in which the

decomposition products are insoluble, and with that modification the procedure was then shown to be applicable to the analysis of samples of insecticidal phenothiazine itself.

All the published color reactions for derris resin or for the rotenone or other constituents contained in it were given comparative trials so that their possibilities and limitations might be learned. The discovery that racemic deguelin forms with carbon tetrachloride a complex that is of low solubility led to the development of a new method for the determination of deguelin in roots and resins, and gives for the first time a convenient means of studying this, the second most important constituent of derris and cube.

Methods suitable for the determination of mercury, fluorine, arsenic, zinc, and copper in impregnated wood were published; the question of estimating the suitability of a particular bog iron ore, or limonite, as a corrective for arsenical damage to soil by determining the amount of iron oxide readily available for reaction with certain test solutions was investigated; a new apparatus was developed for the better testing of geraniol preparatory to its purchase as a means of baiting the Japanese beetle; and the importance of viscosity as a diagnostic property in studying decomposed baits was demonstrated. Improvements were made in the Rast and Segnor methods for determining molecular weights. Finally, a new apparatus was developed for the physical analysis of insecticides, comprising a very simple set-up for determining the average particle size of powdered materials. It is entirely self-contained and portable, occupies only about 1 square foot of space, and even contains an alignment chart which makes the calculations almost automatic. By its use a determination can be made in less than half an hour.

TRANSIT INSPECTION

Inspectors stationed at parcel post, express, and freight terminal points in 16 cities inspected 1,163,897 shipments for compliance with regulations of Federal domestic plant quarantine. Over 930,000 freight waybills were examined to determine certification status of shipments consigned thereunder. There were 3,719 violations intercepted, of which approximately 30 percent were of such nature that they were inspected, certified, and released by transit inspectors. One hundred and forty-eight apparent violations of intrastate quarantines relating to pests on account of which Federal quarantines have been established were reported to State plant-pest-control officials. One of the important phases of transit inspection is reporting to State officials shipments of nursery stock which have been consigned in apparent violation of State certification requirements. Over 550 of this type of shipments were so referred. During November and December the transit inspection force in New York and Boston was materially increased by the assignment of inspectors from another Bureau project so that thorough inspection could be made of the Christmas-season movement of decorative-plant material from the gypsy moth regulated area. This inspection resulted in the interception of approximately 300 shipments of material consigned in apparent violation of the gypsy moth and brown-tail moth quarantine.

Table 14 gives data pertaining to shipments intercepted at transit inspection points.

TABLE 14.—*Shipments of nursery stock and other articles intercepted in violation of Federal domestic plant quarantines at transit inspection points, fiscal year 1939*

Station	Shipments intercepted in apparent violation of quarantines relating to—								
	Black stem rust	Gypsy moth and brown-tail moth	Japanese beetle	Pink bollworm	Thurberia weevil	White pine blister rust	Mexican fruitworm	White-fringed beetle	Total
Atlanta		1	73	1			39		114
Boston		468	264						732
Chicago		35	206	5	1	6	6	1	260
Cincinnati		1	33	9		3	27	1	74
Dallas				9			25		34
Detroit		9	2						11
Indianapolis		1					1		2
Jacksonville		4	126					1	131
Kansas City		4	48	2		1	48		103
New York		383	571			10			964
Omaha		13	103			4		1	121
Philadelphia		64	160			1	17		242
Pittsburgh		14	469			5	23		511
Springfield, Mass.		111	54						165
St. Louis		4	69				64	1	138
St. Paul	1	2	7			22	7		39
State of California		5	48	6	4	15			[1] 78
Total	1	1,119	2,233	32	5	67	257	5	[2] 3,719

[1] Interceptions reported by cooperating State inspectors at several inspection points.
[2] The total number of violations represents 3,628 shipments, 91 of which were in violation of 2 quarantines.

CONVICTIONS AND PENALTIES IMPOSED FOR VIOLATIONS OF THE PLANT QUARANTINE ACT

The following convictions and penalties imposed for violations of the Plant Quarantine Act were reported to the Bureau:

Avocado seed quarantine: One conviction, with a jail sentence of 90 days.

Gypsy moth and brown-tail moth quarantine: Two convictions, with fines aggregating $70.

Japanese beetle quarantine: Four convictions, with fines aggregating $65.

White pine blister rust quarantine: One conviction, with fine of $100.

Quarantines affecting Mexican plants and plant products: Fines aggregating $401.25 were imposed by customs officials on the Mexican border against 379 persons caught attempting to smuggle in prohibited plants and plant products from Mexico.

FOREIGN PLANT QUARANTINES

The Division of Foreign Plant Quarantines is engaged in the enforcement of quarantines and regulatory orders of the Department prohibiting or restricting the entry from foreign countries or the movement from Puerto Rico and Hawaii to the mainland of the United States of various plants and plant products, and restricting the movement of nursery stock into and out of the District of Colum-

bia. In addition, this Division is responsible for the maintenance of a service to inspect and certify plants and plant products to meet the sanitary requirements of foreign countries and for the enforcement of the provisions of the Insect Pest Act of 1905.

Plant-quarantine inspectors and collaborators are stationed at the more important ports of entry and at certain interior ports where foreign mail is distributed. They work in close cooperation with employees of the Treasury and Post Office Departments.

MARITIME-PORT INSPECTION

SHIP INSPECTION

Ships from foreign countries and also those from Hawaii and Puerto Rico and the coastwise ships which pass through the Panama Canal are inspected promptly on arrival for the presence of prohibited and restricted plant material. This inspection involves the examination of ships' stores and quarters, passengers' and crews' baggage, and cargo.

The inspection at ports in California, Florida, and Hawaii and at certain ports in Puerto Rico has been performed by State and Territorial officials serving as collaborators of the Bureau.

A record by ports of the ship inspection appears in table 14.

TABLE 14.—*Number of ships inspected, fiscal year 1939*

Port	From foreign ports												From Hawaii						From Puerto Rico						From United States ports via Panama Canal		
	Direct			Via United States ports			Via Hawaii			Via Puerto Rico			Direct			Via United States ports			Direct			Via United States ports					
	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material
Baltimore	629	628	255	913	769	376										38	2	0	17	17	3	39	33	2	238	94	1
Bellingham [1]	65	65	34	1	1	1							1	1	0										1	1	0
Boston	1,190	1,187	582	433	421	82										17	17	0	13	13	2				225	225	0
Brownsville	14	14	12	22	22	10																					
Brunswick [2]	3	3	3																								
Buffalo	6	5	5																								
Charleston	234	234	76	160	149	72													5	5	0	32	32	1	9	9	0
Chicago	22	22	20																								
Detroit	31	31	21																								
Eureka [3]	4	4	1	6	6	3							1	1	0	2	2	0							3	3	0
Galveston	397	396	233	502	501	296													9	9	1	4	4	0	5	5	0
Georgetown [4]	8	8	7																								
Guam	15	15	12	6	6	0							13	13	9												
Gulfport [5]	15	15	10	88	14	11													1	1	0	9	0	0			
Honolulu [3]	180	180	107	10	10	0																			87	87	0
Houston	548	545	415	476	453	279							1	1	1				8	8	4	2	2	0	40	40	0
Jacksonville [3]	304	304	63	112	103	29													37	37	1	5	4	0	7	7	0
Key West [3]	168	166	84	18	15	0																			1	1	0
Miami [3]	1,394	1,394	392	31	31	13				1	1	1							5	5	0				3	3	0
Mobile	300	300	113	350	333	160										6	6	0	50	50	9	45	44	2	62	62	0
New Orleans	1,159	1,159	680	489	488	317							8	8	5	9	9	0	20	20	4	67	67	1	53	53	0
Newport News	81	81	54	314	309	153										1	1	0	3	3	0	3	3	0	13	12	0
New York	3,783	3,727	2,359	852	707	429				78	78	68	17	17	1	31	25	1	141	139	47	17	8	0	307	209	4
Norfolk	355	355	172	701	693	311				1	1	0							11	11	3	43	43	5	92	92	0
Pensacola [3]	47	47	20	187	187	75													3	3	0	1	1	0			
Philadelphia	697	688	334	1,111	288	165				5	5	1				37	2	0	47	47	11	5	1	0	361	32	3
Port Arthur	426	426	354	338	337	143				1	1	1							13	13	2	4	4	0	20	20	0
Portland, Oreg	158	158	134	376	228	131							3	3	1	19	19	1							3	3	0
Port San Luis [3]	45	45	31										11	11	0										1	1	0
Puerto Rico (all ports)	937	931	316																						12	12	2
San Diego [3]	1,097	1,096	59	16	15	1							33	33	7										195	194	8

See footnotes at end of table.

TABLE 14.—*Number of ships inspected, fiscal year 1939*—Continued

Port	From foreign ports												From Hawaii						From Puerto Rico						From United States ports via Panama Canal		
	Direct			Via United States ports			Via Hawaii			Via Puerto Rico			Direct			Via United States ports			Direct			Via United States ports					
	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material	Arrived	Inspected	With prohibited material
San Francisco [3]	369	369	266	825	825	392	94	94	61	----	----	----	180	180	26	42	42	6	----	----	----	----	----	----	628	628	18
San Pedro [3]	1,486	1,484	918	536	528	213	62	62	39	----	----	----	86	86	23	65	65	15	----	----	----	1	1	0	827	826	93
Savannah	100	100	60	248	248	109	----	----	----	----	----	----	----	----	----	----	----	----	6	6	2	29	29	0	18	18	0
Seattle	1,311	1,188	304	322	317	201	1	1	0	----	----	----	1	1	0	9	9	1	----	----	----	----	----	----	1	1	0
Tampa [3]	294	294	107	287	283	115	----	----	----	----	----	----	----	----	----	----	----	----	16	16	1	1	1	0	2	1	0
Ventura [3]	----	----	----	----	----	----	----	----	----	----	----	----	3	3	0	----	----	----	----	----	----	----	----	----	----	----	----
West Palm Beach [3]	135	135	6	6	6	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1	1	1
Wilmington [4]	37	24	22	7	7	4	----	----	----	----	----	----	----	----	----	----	----	----	1	1	0	----	----	----	----	----	----
Total	18,044	17,823	8,641	9,743	8,300	4,095	157	157	100	86	86	70	358	358	73	276	199	24	406	404	90	307	277	11	3,215	2,640	130

[1] Work handled by inspector stationed at Blaine.
[2] Work handled by inspector stationed at Savannah.
[3] Collaborators stationed at these ports.
[4] Work handled by inspectors stationed at Charleston.
[5] Work handled by inspectors stationed at Mobile.

NOTE.—The foreign-ship arrivals do not in all cases agree with customs figures. Ships which put in for bunkers may not be counted by customs. Ships entered at certain small subports and counted by customs are not included in this report.

CARGO INSPECTION

All importations of plants and plant products subject to plant-quarantine restrictions are inspected at the port of entry or at the port of first arrival. A summary of such importations grouped under four general subdivisions appears in table 15.

TABLE 15.—*Summary of importations of plants and plant products inspected, fiscal year 1939*

Port	Fruits and vegetables			Nursery stock and seeds			Bagging, cotton, cotton products			Bagasse, broomcorn, corn, rice fiber, etc.		
	Lots	Containers	Additional quantities	Lots	Containers	Additional quantities	Lots	Bales	Additional quantities	Lots	Bushels	Additional quantities
		Number			*Number*			*Number*			*Number*	
Baltimore	187		4,148,688 bunches	122	2,366	2,268 pounds	10	1,945		4	3,159	
Bellingham [1]				10	2,639							
Blaine	3	4	350 bunches	126	15,535	50 units, 85 pounds						
Boston	300	36,885	3,412,763 bunches, 316 pounds.	154	2,535	317 units, 10,842 pounds	870	64,641	319 packages	6	3,520	124 bales.
Boston, for export	78	17,987		1	40		14	2,653		4	3,305	
Brownsville	500	4,111	16,721 pounds, 48,311 bunches, 300 fruits.	5		9,771 units	277	22,997	7,487,259 pounds	1		2 bales.
Buffalo	51	5,544		46	76	10,822 units, 1,452 pounds	47	1,034		2	1,004	
Buffalo, for export				2	1	3 units	1	22				
Calexico	224	3,872					374	35,540	13,542,889 pounds			
Calexico, for export	1	1										
Charleston	164	2,807	1,960,527 bunches	13	994		25	3,086				
Chicago	11	12,078		7	644	7 pounds	1	8				
Del Rio	40	69	30 bunches									
Detroit	12	4,166		302	1,864	155 pounds	152	4,122		4	419	4 boxes.
Detroit, for export	1	651										
Douglas	9	48	52,000 pounds									
Eagle Pass	722	23,195	1,997 bunches							2		2 dozen.
El Paso	3,007	65,030	315,957 punches, 2,013,482 pounds.	3	8		47	861	1,004,667 pounds, 9 gallons.	(2)	56	
El Paso, for export	35	252	7 bunches, 11 fruits, 838 pounds.	1		9 pounds				16	298	
Galveston	162		3,517,668 bunches				67	16,395				
Galveston, for export							2	1,098				
Hidalgo	376	1,356		1	1		17	1,066		2	6	
Honolulu [3]	613	4,137		127	513	780 pounds				52		272 containers.
Honolulu, for export	1	17								1		9 containers.
Houston	1	9		1	10		178	52,290	7 packages			
Jacksonville [3]	214	103,843	2,548,789 bunches									
Key West [3]	406	13,177	450 bunches									
Laredo	2,904	328,088	1,915,090 bunches	36	99	3,797 units, 12 pounds						
Mercedes	1	1								1	1	
Miami [3]	1,297	594,693	329,431 bunches, 5,357 fruits.	13	5	1 unit, 1,092 pounds						
Miami, for export				2	1	4½ pounds						
Mobile	171		4,126,911 bunches	23	16,123		24	2,105				
Naco	1	1										
New Orleans	1,336	256,793	12,146,946 bunches, 8,610 pounds, 76 fruits.	20	30,255	40 pounds	111	22,961				

New Orleans, for export.	45	12,958					3	92					
Newport News				4	12								
New York	9,210	3,411,760	12,055,670 bunches, 10,648 fruits, 14 pounds.	1,565	74,223	22,441 pounds	1,317	195,067	181 packages, 20 pounds.	85	48,103	748 containers 40 pounds, 105 cars.
New York, for export	810	359,786		72	3,367		568	83,438	303 packages	19	697	2,614 containers.
Niagara Falls [4]	220	3,521		236	122	8,908 units, 260 pounds	166	3,249				
Niagara Falls, for export.							7	256				
Nogales	2,231	1,036,003	3,576 fruits, 500 bunches.	2		171 units				1		1 container.
Nogales, for export	24	186								1	1,518	
Norfolk	56		523,447 bunches	49	4,543		99	19,396				
Pensacola [3]	1		5,018 bunches									
Philadelphia	174	10,541	4,468,605 bunches	102	8,293	400 units, 1,643 pounds	77	5,831		14	11,497	868 bags, 182 bales.
Philadelphia, for export				2	51							
Port Huron [7]	8	2,220		36	54	639 units, 164 pounds	28	1,581				
Portland	6	30	27,811 bunches	13	295	113 pounds	5	507				
Presidio										2	10	
Providence [5]							28	5,623				
Puerto Rico	69	24,247	2 fruits	74	215	1,178 units, 1,691 pounds, 233 seeds.				156	320,234	
Puerto Rico, for export				1	1							
Roma	2	126										
St. Paul				1	1		22	221				
San Diego [3]	6	855	7,062 bunches	4	6	50 units, 5 pounds						
San Francisco [3]	1,204	16,034	1,712,090 bunches	328	4,815	3 units, 2,345 pounds	101	15,091	1 package	2		26 containers.
San Francisco, for export.	9	14		5	127		7	431	do			
San Luis [6]										2	115	
San Pedro [3]	339	21,787	2,058,859 bunches	84	2,257	17,492 pounds	129	12,584	1 package	1		25 pounds.
San Pedro, for export	2	4										
San Ysidro	37	523		8		1,264 units						
San Ysidro, for export	2	1,900										
Sault Ste. Marie [7]	11		1,819 bunches	2	1	1 unit						
Savannah	5		34,447 bunches	19	4,608		17	7,040				
Seattle	320	267,908	415,140 bunches	318	47,062	5,497 pounds	26	2,297				
Seattle, for export							1	55				
Tampa [3]	1,504	98,050	723,721 bunches, 979 fruits.									
Washington, D. C	2	2		1,688	3,013	10,119 pounds	2	2				
Total	29,125			5,628			4,820			378		
Total all lots, 39,951												

[1] Closed Sept. 10, 1938, and activities since that date handled by inspector stationed at Blaine.
[2] No port record kept of individual lots.
[3] Collaborators stationed at these ports.
[4] Work handled by inspector stationed at Buffalo.
[5] Work handled by inspector stationed at Boston.
[6] Work handled by inspector stationed at Calexico.
[7] Handled through customs.

In addition to the commodities listed in table 15, 1,030 lots of plant material were entered at Canadian border ports where no plant-quarantine inspectors are stationed, through the cooperation of the customs officers and of the Division of Foreign Pests Suppression of the Canadian Department of Agriculture. These importations consisted of 11 lots, containing 1,819 bunches of bananas; 376 lots, consisting of 10,612 bales of bagging, cotton, and cotton waste; 460 lots, totaling 1,709,751 bushels of corn; and 183 lots, consisting of 407 containers and 676 individual plants entering under regulation 15 of Quarantine No. 37.

At the Mexican border ports there were several thousand importations of fruits and vegetables in such small quantities that no entries were required by customs and no plant-quarantine record of them was kept, hence they do not appear in table 15. All these small importations were carefully inspected before being released, and their handling represented a great deal of work, especially at the larger ports. This type of importation has increased very greatly during the last few years.

Many of the ports have devoted considerable time to the inspection of packing materials used in connection with commodities not subject to plant-quarantine restriction. When prohibited packing material is discovered it must be treated or removed and destroyed under the supervision of a plant-quarantine inspector. Shipments of imported liquors have continued to arrive packed with straw jackets which have been contaminated with vetch plants bearing seeds infested with living bruchids. All jackets in which living bruchids were found had to be removed and destroyed or given to fumigation approved for imported vetch seed found to be infested with living bruchids.

DISINFECTION

Disinfection is required of certain commodities as a condition of entry and of other commodities when inspection reveals the presence of injurious insects or plant diseases. The following plant material was treated under the supervision of inspectors and collaborators of this Bureau:

Cotton	131,161 bales.
Cotton waste	17,653 bales, 40 bags.
Cotton linters	54,253 bales.
Cotton samples	13,687 packages.
Bagging	2,905 bales.
Rags	473 bales.
Broomcorn	190 bales.
Vetch	2,273 bags.
Rice fiber	580 bales.
Narcissus	3,877 cases, 37 bags, 80 baskets.
Tree seeds	457 containers, 10,553 pounds.
Miscellaneous plants	2,769 containers, 2,723 units.[1]
Chestnuts	2,624 cases, 221 barrels.
Cipollini	9,925 cases.
Lima beans	12,502 hampers.
Pigeonpeas	97 hampers.
Lily bulbs	438 cases.
Kudzu seed	9 bags, 2 cases.
Vicia faba	51 bags.

[1] Refers to plants, cuttings, bulbs, roots, or other propagating units concerned.

As a result of experiments conducted by the Division of Control Investigations the use of methyl bromide was approved for the fumigation of lima beans infested with the bean pod borer (*Maruca testulalis* (Geyer)) and of cipollini infested with *Exosoma lusitanica* (L.). Prior to this year infested lima beans were refused entry, and infested cipollini were either refused entry or given a hot-water treatment.

AIRPLANE INSPECTION

The number of airplanes from foreign countries continues to increase from year to year, and the possibility of introducing plant pests through this rapid means of transportation increases accordingly. During the year 4,969 airplanes from foreign countries were inspected. These inspections were made at the following 19 ports of entry: Douglas and Nogales, Ariz.; Calexico, Los Angeles, San Diego, and San Francisco, Calif.; Key West, Miami, Tampa, and West Palm Beach, Fla.; Agana, Guam; Honolulu, T. H.; Baltimore, Md.; New York, N. Y.; San Juan, P. R.; Brownsville, El Paso, and Laredo, Tex.; and Seattle, Wash.

Seven hundred and seventy-nine of the airplanes inspected were found to carry prohibited plant material, much of which came from places where it is known to be the host of injurious plant pests. Two thousand four hundred and forty-five interceptions of insects and plant diseases were made in connection with the airplane inspection. These represented specimens taken from plant material carried in baggage, cargo, and stores, and also insects which were being carried as stowaways on the planes. These interceptions are not only of interest as possible plant pests, but many of them represented different species of mosquitoes and other insects which might have decided importance, from the human-health standpoint.

While the majority of the interceptions represented forms which may be considered as having little economic importance, there were many interceptions which could be identified as to genus only, hence it is impossible to estimate their importance from a plant-pest standpoint. Interceptions of such well-known pests as fruitflies belonging to the genus *Anastrepha*, species of Aleyrodidae and *Pseudococcus*, the bean pod borer (*Maruca testulalis* (Geyer)), and several species of scale insects were included.

FOREIGN PARCEL-POST INSPECTION

Inspection of foreign parcel-post packages is carried on through the cooperation of customs and post-office officials. Under an arrangement which has been in effect many years, foreign mail packages found to contain plants or plant products are referred to inspectors of this Bureau for examination. Such packages arriving at ports of entry where no plant-quarantine inspectors are stationed are forwarded to the nearest port where inspection can be made.

A record by port of the number and disposition of foreign parcel-post packages inspected appears in table 16.

TABLE 16.—*Foreign parcel-post packages inspected, fiscal year 1939*

Port	Inspected	Refused entry (entire or in part)	Diverted to Washington	Released under permit
Atlanta [1]	77	9	40	0
Baltimore	1,250	26	114	64
Boston	7,093	75	1,499	99
Brownsville	1,061	1	0	0
Buffalo	1,550	25	177	31
Chicago	15,577	180	167	124
Detroit	5,569	89	106	120
Eagle Pass	485	0	0	0
El Paso [2]	542	26	23	8
Galveston	5	0	3	0
Guam	74	0	0	0
Honolulu [1]	2,448	293	0	191
Houston [3]	224	3	0	0
Jacksonville [1]	88	11	10	13
Laredo	1,048	22	31	3
Los Angeles [1] [4]	4,965	71	13	31
Miami [1]	105	15	18	2
New Orleans	347	8	106	21
New York	335,114	416	4,670	342
Nogales [5]	351	11	5	2
Philadelphia	34,563	91	400	84
Portland [6]	1,047	19	0	32
Puerto Rico (all ports)	34	1	0	28
St. Paul	27,565	58	76	71
San Diego [1]	32	1	0	0
San Francisco [1]	5,627	94	4	790
Seattle	1,594	25	2	306
Tampa [1]	1	1	0	0
Washington	19,282	221		3,929
Total	467,718	1,792	7,464	6,291

[1] Collaborators are stationed at these ports.
[2] 13 packages were diverted to San Francisco for disposition.
[3] 116 packages (cotton samples) were diverted to Brownsville for fumigation.
[4] 99 packages were diverted to San Francisco and 1 to Seattle for disposition.
[5] 12 packages were diverted to San Francisco for disposition.
[6] 7 packages were diverted to Seattle for disposition.

It has been the practice for a number of years to admit shamrocks through the mails provided they are free from soil. Large numbers are brought in in this manner each year, and they are included in table 16.

MEXICAN-BORDER SERVICE

At the beginning of the year certain of the newer types of boxcars, which are so constructed as to make it practically impossible for cottonseed to become concealed in them, were added to the list of cars which are exempted from fumigation provided that they are found, upon inspection, to be free from cottonseed. This added exemption, together with the decrease in the number of freight cars coming out of Mexico, was responsible for a decided decrease in the number of cars fumigated. All cars found contaminated with cottonseed were required to be cleaned before entry was permitted. The usual fee of $4 was charged for each car fumigated, and all fees collected were covered into the Treasury as miscellaneous receipts.

A summary of the railway-car inspection and fumigation is shown in table 17.

TABLE 17.—*Inspection and fumigation of railway cars crossing the border from Mexico, fiscal year 1939*

Port	Cars inspected	Cars with cottonseed	Cars entered	Cars fumigated	Fees collected
	Number	*Number*	*Number*	*Number*	*Dollars*
Brownsville	1,209	15	1,209	[1] 3	12
Douglas	2,291	11	2,291	34	136
Eagle Pass	2,073	317	2,073	576	2,200
El Paso	10,517	553	9,997	[2] 924	3,524
Laredo	11,861	1,404	10,834	1,651	7,200
Naco	903	10	903	7	28
Nogales	6,098	469	5,874	819	3,200
Presidio	560	18	560	10	40
Total	35,512	2,797	33,741	4,024	[3] 16,340

[1] Includes 2 trucks containing cotton machinery.
[2] Includes 5 cars and 1 truck not from Mexico.
[3] The apparent discrepancy in fees collected and the number of cars fumigated may be explained by the fact that it is customary for the railroads to purchase fumigation coupons in advance.

In addition to the freight cars listed in table 17, 4,480 pullman and passenger coaches entered and were inspected at the following ports: El Paso, 1,293; Laredo, 2,803; Nogales, 381; and Douglas, 3.

The improvement of highways in Mexico has resulted in a considerable increase in automobile traffic between the two countries. The records reveal that 4,019,169 vehicles and 340,487 pieces of personal baggage were examined, in cooperation with the customs service.

INSPECTION IN PUERTO RICO AND HAWAII

The enforcement of Quarantine No. 58, governing the movement of fresh fruits and vegetables from Puerto Rico to the mainland, is taken care of by plant-quarantine inspectors stationed on the island. Inspections are made in the orchards and fields, in packing houses, and on the docks, of such fruits and vegetables as are permitted to move to the mainland. During the year 2,812 shipments, consisting of 780 bunches of bananas, 474,813 crates of pineapples, and 24,477,500 pounds of other approved fruits and vegetables were certified for such movement.

While there has been a decided decrease in the amount of grapefruit shipped from the island to the mainland during the last few years, there has been an increase in other commodities. Exclusive of bananas and pineapples, the total quantity of other approved fruits and vegetables for the fiscal year 1938 amounted to 14,426,534 pounds. For the fiscal year 1939 these figures were increased to 24,477,500. The items responsible for most of this increase were cucumbers, plantains, tomatoes, and yams.

With the cooperation of post-office officials, parcel-post packages destined for points on the mainland were inspected at the four main post offices on the island. This arrangement makes it possible to intercept much prohibited plant material before it leaves the island and also reduces considerably the number of Puerto Rican mail packages requiring inspection on arrival in New York.

A total of 2,671 parcel-post packages were examined, and 160 were found to contain prohibited plant material and were returned to the sender.

The enforcement of foreign plant quarantines and regulations as they affect the entry of foreign plants and plant products into the island is under the general supervision of the inspector in charge of

the enforcement of the provisions of Quarantine No. 58. However, valuable assistance in this work is rendered by insular inspectors serving as collaborators.

In Hawaii the enforcement of foreign plant quarantines is handled wholly by insular inspectors serving as collaborators. The inspectors of this Bureau stationed in the Hawaiian Islands are engaged in the enforcement of Quarantine No. 13, which governs the movement of fresh fruits and vegetables to the mainland. Effective November 1, 1938, administrative instructions were issued authorizing the shipment of fruits and vegetables from Hawaii to the mainland subject to sterilization under supervision. Extensive experiments had demonstrated that the holding of fruits and vegetables at certain prescribed temperatures for certain periods would kill all stages of the Mediterranean fruitfly and the melonfly. This made it possible to ship host fruits and vegetables of these two insects, which prior to this date had been refused movement to the mainland. Supervising the approved treatments as outlined in B. E. P. Q. 481 has increased considerably the work of the plant-quarantine inspectors stationed in Hawaii.

During the year 2,721 shipments, consisting of 108,562 bunches of bananas, 105,010 crates of pineapples, 42,620 coconuts, and 2,269,485 pounds of other approved fruits and vegetables, were inspected and certified for movement to the mainland. Of these, 69,363 pounds were papayas and 28,117 were avocados which had been given the approved sterilization treatments in Hawaii under close supervision.

Inspections were made in the fields, in packing houses, and on the docks. The inspection of parcel-post packages destined for points on the mainland requires considerable time and effort. During the year 323,055 such packages were handled; 95,868 of these were opened and inspected, and 106 were found to contain prohibited plant material.

Since the inauguration of trans-Pacific air service it has been the practice not only to inspect the planes when they arrive from the Orient but also to inspect all planes, baggage, and express before the planes leave Honolulu for California. This procedure serves as an added precaution against the carrying of plant pests from Hawaii to the mainland and permits the prompt release of baggage and express upon arrival at the mainland. Under this arrangement 41 airplanes, 1,406 pieces of baggage, and 2,555 air-express packages were inspected. The airplanes arriving in Hawaii from foreign countries are included under the heading Airplane Inspection.

Other activities in Hawaii consisted in the inspection and sealing of 3,162 pieces of baggage and the inspection of 530 pieces of express leaving Hawaii by boat.

INSPECTION OF SPECIAL-PERMIT AND DEPARTMENTAL PLANT MATERIAL

Importations of propagating plant material are inspected at special ports of entry designated for that purpose. Most of such importations are inspected and treated at the inspection house in Washington, D. C., and it was the practice in past reports to include a table summarizing the inspection of plants and plant products in the District of Columbia. This table has now been discontinued, and Washington has been given the same status as other ports of entry in tables 14, 15, 19, and 20.

Recognition, however, should be given to the fact that the greater part of the importations handled in Washington, D. C., represented special-permit material and, as such, received very close inspection and frequently some sort of treatment as a condition of entry.

The enforcement of the regulations governing the movement of plant material into and out of the District of Columbia required the inspection of 1,164 shipments of incoming domestic material (consisting of 326,895 plants, cuttings, bulbs, etc., and 3,026 lots of seeds), 234 of which received some form of treatment for the elimination of pests; and 8,272 shipments of outgoing domestic material (consisting of 214,151 plants, cuttings, bulbs, etc., and 11,063 lots of seeds), 404 of which required treatment. In addition, 10,009 containers of domestic plant material were inspected at the post office and at railway and express stations. Twenty-one and one-half carloads of plants included in these figures are designated as 21½ containers.

INSPECTION OF PLANT-INTRODUCTION AND PROPAGATING GARDENS

Plant material which is being propagated at plant-introduction gardens maintained by the Bureau of Plant Industry is inspected at regular intervals for the presence of plant pests. Plant material distributed from the plant-introduction gardens at Coconut Grove, Fla., and Mandan, N. Dak., was inspected by State officials cooperating with this Bureau. The inspections at the plant-introduction garden at Chico, Calif., were handled jointly by an inspector of this Bureau and an entomologist from the California State Department of Agriculture. Material distributed from the District of Columbia, Maryland, and Savannah, Ga., was inspected by inspectors of the Bureau. A summary of these inspections appears in table 18.

TABLE 18.—*Plants, bud sticks, cuttings, tubers, roots, and shipments of seeds examined for distribution from plant-introduction and propagating gardens, fiscal year 1939*

Garden	Plants	Shipments of seeds	Bud sticks and cuttings	Roots and tubers
Bell, Md.	44,660	42	1,928	5,520
Chico, Calif.	5,314	61	3,912	35
Coconut Grove, Fla.	11,531	91	952	46
Savannah, Ga.	7,082	3	729	96
District of Columbia	9,186	10,687	3,545	20,133
Mandan, N. Dak.	253,390			
Total	331,163	10,884	11,066	25,830

INTERCEPTIONS OF PROHIBITED AND RESTRICTED PLANTS AND PLANT PRODUCTS

The inspection of ships, airplanes, vehicles, cargo, baggage, ship's stores and quarters, and foreign mail packages at the various maritime and border ports of entry resulted in the interception of large quantities of prohibited and restricted plant material. Much of this intercepted plant material was infested with insects or infected with plant diseases of considerable economic importance. In classifying the interceptions, those made at bridges and crossings at the Mexican and Canadian border ports have been considered as having been taken from baggage. A record of the number of interceptions of prohibited and restricted plant material appears in table 19.

TABLE 19.—*Number of interceptions of prohibited and restricted plants and plant products, fiscal year 1939*

Port	In baggage		In cargo		In mail		In quarters		In stores		Total	
	Prohibited	Restricted	Prohibited	Restricted	Prohibited	Restricted	Prohibited	Restricted	Prohibited	Prostricted	Prohibited	Restricted
Baltimore	6	2	57	0	25	6	78	0	168	3	334	11
Blaine	1,310	594					1	1	18	14	1,329	609
Boston	130	80	12	8	44	49	23	6	119	44	328	187
Brownsville	4,955	667			0	1					4,955	668
Brunswick [1]							6	0			6	0
Buffalo [2]	4	435	5	7	16	11					25	453
Calexico	3,484	102									3,484	102
Charleston	7	4					21	0	7	0	35	4
Chicago			35	12	101	58					136	70
Del Rio	699	173									699	173
Detroit	17	427	6	3	80	17					103	447
Douglas	441	84									441	84
Eagle Pass	1,311	237									1,311	237
El Paso	6,559	931	94	14	28	6					6,681	951
Galveston							444	3	102	0	546	3
Guam	7	0	5	0			2	0	7	0	21	0
Gulfport [3]	1	0					30	0	7	0	38	0
Hidalgo	3,287	428									3,287	428
Honolulu [4]	681	250	113	6	246	7			19	0	1,059	263
Houston	4	1	1	0	4	0	412	0	69	0	490	1
Jacksonville [4]					9	1	18	12	20	2	47	15
Key West [4]	92	67	1	0			20	27	10	0	123	94
Laredo	12,952	996	1	0	16	2					12,969	998
Los Angeles [4]	7	2	0	1	66	6					73	9
Mercedes	194	42									194	42
Miami [4]	1,437	1,076	29	3	15	0	339	597	113	4	1,933	1,680
Mobile	12	2	0	3			151	2	68	1	231	8
Naco	114	31									114	31
New Orleans	386	96	4	6	7	1	766	86	122	1	1,285	190
Newport News							15	14	12	1	27	15
New York	2,419	1,117	364	51	322	223	171	46	42	4	3,318	1,441
Nogales	3,524	760			4	9					3,528	769
Norfolk	5	4					85	10	31	1	121	15
Pensacola [4]							17	0	8	0	25	0
Philadelphia	13	12	28	3	89	12	68	17	48	3	246	47
Port Arthur	11	1	1	0			886	0	139	0	1,037	1
Port Huron [5]	2	325									2	325
Portland	2	0	3	0	8	12	12	0	24	3	49	15
Port San Luis [4]							1	0	1	0	2	0
Presidio	130	19	1	0							131	19
Puerto Rico (all ports)	65	71					2	3	2	0	69	74

Roma	110	25	1	0							111	25
St. Paul					42	16					42	16
San Diego [4]	2	6	1	0			49	9	51	9	103	24
San Francisco [4]	253	7	40	4	66	33	151	2	79	1	589	47
San Pedro [4]	440	27	21	0			90	5	176	2	727	34
San Ysidro	7,668	649									7,668	649
Sault Ste. Marie [5]	0	14									0	14
Savannah	3	0					67	0	6	0	76	0
Seattle	377	18	42	5	16	7	7	3	39	0	481	33
Tampa [4]	26	42	1	0			16	3	33	0	76	45
West Palm Beach [4]							4	1			4	1
Wilmington [6]									2	0	2	0
Total	53,147	9,824	866	126	1,204	477	3,952	847	1,542	93	60,711	11,367

[1] Work handled by inspector stationed at Savannah.
[2] Includes interceptions made at Niagara Falls.
[3] Work handled by inspectors stationed at Mobile.
[4] Collaborators stationed at these ports.
[5] Handled through customs.
[6] Work handled by inspector stationed at Charleston.

PESTS INTERCEPTED

The inspectors and collaborators of the Bureau collected from foreign plants and plant products insects belonging to 1,237 recognized species and others distributed among 983 genera and families, fungi and bacteria belonging to 321 recognized species, plant-parasitic nematodes belonging to 11 species, and numbers of interceptions caused by fungi, bacteria, viruses, or other agents that could be referred to family, genus, or other group only. Many of these interceptions were of economic importance or of scientific interest, or both.

A total of 57,561 interceptions of insects and plant diseases were made during the year. A summary of the interceptions appears in table 20.

TABLE 20.—*Number of interceptions of insects and plant diseases made during the fiscal year 1939*

Port	Cargo		Stores		Baggage		Quarters		Mail		Total	
	Insects	Diseases	Insects	Diseases	Insects	Diseases	Insects	Diseases	Insects	Diseases	Insects	Diseases
Baltimore	54	14	35	18	1	0	1	1	13	5	104	38
Bellingham [1]	2	3	3	0	0	0	0	0	0	0	5	3
Blaine	23	4	3	0	5	0	0	0	0	0	31	4
Boston	175	199	147	210	62	39	21	14	148	84	553	546
Brownsville	675	96	10	14	6,144	1,814	29	0	4	1	6,862	1,925
Buffalo	84	170	0	11	0	2	0	0	62	9	146	192
Calexico	0	2	0	0	172	12	0	0	0	0	172	14
Charleston	67	1	2	1	0	0	1	0	0	0	70	2
Chicago	56	12	1	0	0	0	0	0	39	3	96	15
Del Rio	0	0	0	0	395	0	0	0	0	0	395	0
Detroit	1	5	0	0	1	0	0	0	19	9	21	14
Douglas	2	1	0	0	418	3	0	0	0	0	420	4
Eagle Pass	103	0	0	0	257	0	0	0	0	0	360	0
El Paso	883	61	0	0	1,947	431	0	0	18	0	2,848	492
Galveston	283	19	20	82	0	0	15	1	0	0	318	102
Guam	1	0	0	1	0	0	996	0	0	0	997	1
Hidalgo	91	26	0	0	445	823	0	0	0	0	536	849
Honolulu	344	0	20	0	94	0	274	0	197	0	929	0
Houston	0	0	107	280	0	0	14	0	0	0	121	280
Jacksonville [2]	15	0	18	34	1	0	7	0	1	0	42	34
Key West [2]	1	0	6	1	35	5	0	0	0	0	42	6
Laredo	3,791	5	1	0	4,519	11	0	0	11	2	8,322	18
Los Angeles	2	0	0	0	0	0	1	0	12	2	15	2
Mercedes	0	0	0	0	212	8	0	0	0	0	212	8
Miami [2 3]	74	9	27	36	380	35	357	18	5	1	843	99
Mobile [4]	35	0	15	17	2	5	7	2	0	0	59	24
Naco	2	0	0	0	58	0	0	0	0	0	60	0
New Orleans	506	7	112	33	50	2	29	6	9	0	706	48
Newport News	4	0	2	9	0	0	0	0	0	0	6	9
New York	1,886	2,631	350	469	508	343	113	83	628	97	3,485	3,623
Nogales	2,792	645	0	0	1,793	131	0	0	5	0	4,590	776
Norfolk	81	17	25	35	4	0	0	2	0	0	110	54
Pensacola [2]	0	0	0	0	0	4	1	0	0	0	1	4
Philadelphia	79	269	69	997	14	18	13	67	48	115	223	1,466
Port Arthur	0	0	73	102	1	0	2	1	0	0	76	103
Portland	28	20	15	9	0	0	0	0	0	1	43	30
Presidio	0	0	0	0	31	2	0	0	0	0	31	2
Roma	0	0	0	0	6	7	0	0	0	0	6	7
St. Paul	0	0	0	0	0	0	0	0	17	8	17	8
San Diego [2]	12	0	28	5	5	0	5	1	6	0	56	6
San Francisco [2]	1,727	333	112	13	1,019	12	65	2	654	133	3,577	493
San Juan	25	6	1	0	30	4	2	2	6	1	64	13
San Pedro [2]	267	9	417	102	286	16	33	0	0	0	1,003	127
San Ysidro	8	3	0	0	840	3	0	0	0	0	848	6
Savannah	10	0	3	21	0	0	0	0	0	0	13	21
Seattle	434	201	61	45	37	17	21	11	57	29	610	303
Tampa [2]	2	7	9	11	12	9	2	0	1	0	26	27
Washington, D. C	1,638	2,407	0	0	134	47	0	0	1,176	525	2,948	2,979
Total	16,263	7,182	1,692	2,556	19,918	3,803	2,009	211	3,136	1,025	43,018	14,777

[1] Closed Sept. 10, 1938.
[2] Collaborators stationed at these ports.
[3] Includes 157 airplane interceptions made by the Public Health Service.
[4] Includes interceptions made at Gulfport, Miss.

NOTE.—Inspectors stationed at Puerto Rico made 7 interceptions of insects during their field and packing-house inspection of fruits and vegetables for shipment to the mainland.

CERTIFICATION FOR EXPORT

During the year 9,412 certificates covering 3,591,165 containers of plants and plant products were issued to meet the sanitary requirements of foreign countries. This represents an increase of 204 in the number of certificates and a decrease of 426,642 in the number of containers certified, compared with the fiscal year 1938.

Export certificates were issued at 37 ports covering 65 different commodities which were exported to 83 foreign countries. Some of the more important commodities certified were the following: Apples, 2,170 shipments consisting of 1,362,106 boxes, 17,785 barrels, 56,484 baskets, and 181 packages; oranges, 1,137 shipments consisting of 566,267 boxes; pears, 823 shipments consisting of 500,639 boxes and 11,948 baskets; potatoes, 1,615 shipments consisting of 602,922 bags, 18,705 crates, 9,145 barrels, and 90 boxes.

Many of the shipments of apples and pears were certified under the cooperative arrangement with the Bureau of Agricultural Economics of the Department, whereby licensed inspectors of that Bureau located at shipping points make inspections and issue reports which are accepted by the plant-quarantine inspectors at the ports of export as a basis for issuing the required export certificate.

A brief summary of the export-certification work appears in table 21.

TABLE 21.—*Certification for export, by port, fiscal year 1939*

Port	Certificates issued	Total containers certified	Commodities certified	Foreign countries	Port	Certificates issued	Total containers certified	Commodities certified	Foreign countries
	Number	*Number*	*Number*	*Number*		*Number*	*Number*	*Number*	*Number*
Atlanta	1	29	1	1	New Orleans	74	19,004	9	7
Baltimore	15	34	3	4	Newport News	27	475	1	1
Boston	16	2,576	3	8	New York	5,021	1,283,756	33	63
Brownsville	61	35,487	3	1	Nogales	50	126	3	1
Buffalo	1	2	1	1	Norfolk	8	180	1	1
Calexico	91	51,090	5	1	Pensacola	1	150	1	1
Canal Zone	14	16	1	9	Philadelphia	9	14	3	4
Chicago	[1] 6	4	2	2	Port Arthur	4	3,700	1	4
Detroit	153	2,664	4	9	Portland	546	326,972	4	15
Eagle Pass	4	21	2	1	Presidio	1	918	1	1
El Paso	49	5,184	13	1	San Diego	3	3	1	1
Galveston	10	12	1	2	San Francisco	583	184,810	20	17
Hidalgo	21	989	3	1	San Juan	1	5	1	1
Honolulu	1	1	1	1	San Pedro	867	425,005	6	5
Houston	5	1,244	3	5	Seattle	1,480	1,149,363	14	15
Jacksonville	119	82,604	4	5	Tampa	3	4,396	2	2
Laredo	4	86	2	1	Washington	11	17	5	10
Los Angeles	121	8,565	9	3					
Mayaguez	22	44	2	12	Total	9,412	3,591,165	-------	-------
Mobile	9	1,619	4	2					

[1] Includes 1 duplicate certificate and 1 certificate for commodity not exported.

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REPORT OF THE CHIEF OF THE OFFICE OF EXPERIMENT STATIONS, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., September 1, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I transmit herewith a report of the Office of Experiment Stations for the fiscal year ended June 30, 1939.

Sincerely yours,

JAMES T. JARDINE, *Chief.*

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INTRODUCTION

During the fiscal year, as formerly, the work of the Office of Experiment Stations embraced a group of activities concerned with the planning, coordination, and administration of research. These activities included the administration of Federal grants for the support of research in agriculture, the rural home, and rural life by experiment stations in the States, Alaska, Hawaii, and Puerto Rico; the supervision of the experiment station of the Department of Agriculture in Puerto Rico; the administration of the special research fund, Department of Agriculture; and the coordination of research work in the Department of Agriculture, among the experiment stations and between the Department and the stations.

The Chief of the Office, as Director of Research, with the cooperation of the bureaus involved has responsibility for the planning and coordination of the programs of the four utilization-of-farm-products regional laboratories. A great deal of attention was given during the year to advisory work relating to the planning, organization, and establishment of these laboratories.

The increase in allotments of Bankhead-Jones funds to the experiment stations, together with the responsibility for examining additional expenditures of State funds offered as offset, likewise added to the volume of work of the Office.

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To facilitate the handling of the increased duties and responsibilities of the Office pertaining to the administration of the Federal-grant funds, R. W. Trullinger was designated Assistant Chief.

ADMINISTRATION OF FEDERAL GRANTS TO THE STATES

A considerable part of the work of the Office concerns the administration of the funds for agricultural research made available to the States through annual congressional appropriations under the provisions of the Hatch, Adams, and Purnell Acts, title I of the Bankhead-Jones Act of June 30, 1935, and the supplementary acts. This involves examination and approval of new and revised research projects in advance of the expenditure of funds, examination and approval of research programs and budgets, and review of the work and examination of the expenditures at each station, including those under State funds submitted as offset to the Bankhead-Jones funds, as a basis for certification of the stations to receive Federal funds.

The examination and approval of projects submitted by the stations during the year for proposed Federal-fund expenditures included 344 new and 122 revised project outlines showing such detail as objectives, reasons for undertaking the study, previous work and present outlook on the problem, procedure, probable duration, financial support, personnel, and cooperative relationships. Each of these proposals was examined for conformity with the provisions of the Federal acts and as to possibilities for coordination and cooperation with research along similar lines in progress in other State stations and in the Department. Appropriate suggestions for changes or additions in procedure and other particulars were offered with the view of enhancing the productiveness and soundness of the work.

There were under investigation during the year 523 Adams projects, 1,680 Purnell projects, and 818 Bankhead-Jones projects, a total of 3,021 projects financed wholly or in part from Federal funds. The research programs of the stations also included a large number of projects supported solely from State appropriations or other supplemental sources. The total number of projects supported from all sources, including Federal funds, was approximately 8,500.

In carrying out the provisions of the several Federal acts and the act making appropriations for the current year, the Office received and examined for each station the annual financial statement, the annual program of projects with proposed expenditures, and a statement guaranteeing the amount of State funds to be made available as offset to the Bankhead-Jones funds.

Representatives of the Office visited each of the stations during the year and examined vouchers covering the expenditures of Federal funds, also State funds in the amounts required to offset the Bankhead-Jones fund allotments. The work accomplished under each Federal-fund project was discussed with the project leader, and consideration was given to future plans. The visits also afforded opportunity for discussions with directors and suggestions to them covering general matters of station administration, such as accounting procedure, personnel problems, research facilities, coordination and cooperation in research, and institutional and State relationships. They supplemented extensive correspondence and Office conferences on such matters.

During the year ended June 30, 1939, the Federal grants to the States, Alaska, Hawaii, and Puerto Rico for agricultural research at the State and Territorial experiment stations amounted to $6,541,250, as compared with $6,232,500 in 1938. This represented an increase of $308,750 over the preceding year.

Under the Hatch, Adams, and Purnell Acts each State received $90,000, Alaska, $23,750; Hawaii, $55,000; and Puerto Rico, $42,500. In addition to these amounts, $2,100,000, provided for the States, Territories, and Puerto Rico under the Bankhead-Jones Act, was allotted on the basis of their respective rural populations, as specified in the act.

The supplementary income of the experiment stations in 1938 was $13,615,568.43, as compared with $12,074,252.72 in 1937, an increase of $1,541,315.71, or nearly 13 percent over the preceding year.

The total funds available from Federal and supplementary sources for the fiscal year ended June 30, 1938, amounted, therefore, to $19,848,068.43. While the exact total of supplementary income for 1939 is not known at this time, it is estimated to equal or exceed $13,800,000, which with the amounts received from Federal sources would bring the total income from all sources to more than $20,000,000.

SUPERVISION OF THE PUERTO RICO EXPERIMENT STATION

Supervision of the experiment station of the Department of Agriculture in Puerto Rico involves responsibility for the research program and relationships; approval of research projects, budgets, and expenditures; the review, editing, and approval of publications; and general administrative direction. Particular attention is given by the Office to coordinating the research of this Federal station at Mayaguez and other research of the Department on the island with the work of the experiment station of the University of Puerto Rico at Rio Piedras, which receives Federal grants for agricultural research, authorized by the Hatch and supplemental acts, under the congressional act of March 4, 1931. The primary functions of the Federal station are to serve national interests. The work of the university station deals chiefly with agricultural and rural-life problems of Puerto Rico, and the two stations cooperate in the study of problems of mutual interest.

In carrying out its function as an outpost of the Department in the Tropics, the Puerto Rico Station, in cooperation with the Bureau of Plant Industry, has continued investigations of quinine production. After some difficulties *Cinchona* trees are now being grown and have been brought to maturity, producing viable seeds. Studies of rotenone-bearing plants have been continued in cooperation with the Bureaus of Plant Industry and Entomology and Plant Quarantine. Some of the environmental factors contributing to an increased rotenone content of such plants have been determined. In the work on the introduction and colonization of beneficial insects in cooperation with the Bureau of Entomology and Plant Quarantine, the outstanding contribution of the year has been the successful introduction of the cold- and drought-resistant strain of the Amazon fly (*Metagonistylum minense*), the parasite of the cane and corn top borer (*Diatraea saccharalis*). Other research on which progress was recorded included the propagation of the coca plant, looking toward a possible domestic supply of the drug co-

caine; the control of important insect pests of sweet corn; investigations of climatic and soil conditions best suited to vanilla production, and of curing methods for vanilla beans; studies of methods of extraction and chemistry of essential oils of locally known and also introduced plants; culture of tropical fruits and spice plants; and research on the possible improvement through the use of colchicine of economic plants adapted to growth conditions on the island. Evidence has continued to accumulate indicating that the island can serve advantageously as a winter breeding station for certain vegetable and field crops, thus supplementing and accelerating the breeding programs of the Department and the State experiment stations.

Work on problems relating to the agriculture of the island is being carried on in cooperation with the government of Puerto Rico, which, in 1939, made available personnel and facilities amounting to approximately $26,900.

The station has been of considerable service to various islands of the Caribbean Sea and to countries in Central America and South America by making available to them shipments of beneficial insects and propagating material of certain crop plants. During the year, the Director served part time as agricultural adviser to the Haitian Government under designation by the President, in accordance with Public, No. 545, Seventy-fifth Congress, approved May 25, 1938.

The station also has provided office space, laboratory facilities, land, and other facilities for units of the Soil Conservation Service and the Forest Service of the Department, and office and storage space for the Geological Survey of the Department of the Interior. The work of the station was greatly expedited by labor made available by the Civilian Conservation Corps and by technical personnel, labor, equipment, and supplies furnished by the Puerto Rico Reconstruction Administration.

ADMINISTRATION OF THE SPECIAL RESEARCH FUND

The general administration of the fund, known as the special research fund, authorized under the Bankhead-Jones Act of June 29, 1935, is assigned to the Director of Research and Chief of the Office of Experiment Stations. This responsibility includes the planning and coordination of the Department's research program under this fund, and the coordination of this research with all research of the Department and State experiment stations.

In accordance with the terms of the authorizing act, 50 percent of the $1,400,000 appropriated for the year 1939 was available for research laboratories in the major agricultural regions, 48 percent for special research projects of the Department, and 2 percent for administration of the allotments of Bankhead-Jones funds to the States, Territories, and Puerto Rico.

REGIONAL LABORATORIES

Regional research laboratories authorized by the Bankhead-Jones Act have now been established at nine centers, each with a specific research program of major importance in the region served. The year of establishment, character of work, location, the bureau or bureaus having immediate direction of the work or cooperating in it, and the regional group of cooperating State experiment stations for each of these nine laboratories are given in table 1.

TABLE 1.—*Character of research conducted by the 9 regional laboratories, their location, and States cooperating*

Year established	Character of research	Location	Bureaus cooperating	States cooperating
1935	Improvement of vegetables through breeding.	Charleston, S. C.	Plant Industry	13 Southeastern.
1935	Improvement of pastures.	State College, Pa.	do	12 Northeastern.
1936	Industrial utilization of soybeans.	Urbana, Ill.	Agricultural Chemistry and Engineering, and Plant Industry.	12 North Central.
1937	Improvement of swine through breeding.	Ames, Iowa	Animal Industry	12 North Central and Oklahoma.
1937	Improvement of sheep through breeding.	Dubois, Idaho	do	12 Western.
1937	Animal-disease research.	Auburn, Ala.	do	13 Southeastern.
1938	Improvement of viability in poultry.	East Lansing, Mich.	do	13 North Central and 12 Northeastern.
1938	Salinity of irrigation waters.	Riverside, Calif.	Plant Industry, and Agricultural Chemistry and Engineering.	11 Western and Hawaii.
1939	Relation of soils to plant, animal, and human nutrition.	Ithaca, N. Y.	Plant Industry, Animal Industry, Dairy Industry, and Home Economics.	12 Northeastern and other research agencies.

Since coordination of research is an important function of the regional laboratories, the research program of each is reviewed annually by a group of collaborators, one for each cooperating station, who assist in planning the work of the laboratory and in coordinating work along similar lines in the cooperating States. They meet with representatives of the Office of Experiment Stations and the bureau or bureaus having supervision of the work of the laboratory and review with the director and staff the work accomplished and the program for the ensuing year. One or more meetings of collaborators were held during the year at each regional laboratory, except for the newly organized laboratory at Ithaca, N. Y., for which the collaborators had not been selected.

The programs and accomplishments of the regional laboratories are discussed briefly in the paragraphs that follow.

VEGETABLE-BREEDING IMPROVEMENT

Noteworthy progress was made at the vegetable-breeding laboratory near Charleston, S. C., in attacking the problem of breeding varieties of vegetables better adapted to the climate and soil conditions faced by southern vegetable growers and home gardeners. Since these conditions vary quite widely within the 13 cooperating Southeastern States, the laboratory gives particular emphasis to determining the genetic principles underlying the inheritance of desired characteristics among the kinds of vegetables selected for study, and distributes stocks having these characteristics from which the State collaborators may select the strains that prove best adapted to their conditions. A clearer understanding as to the method of inheritance in watermelons of weight and shape of fruit, color and length of seed, and sex variations in flowers was obtained during the year. Of the 186 selfed lines of watermelons that are reputedly resistant to wilt now on hand, it is hoped that some will breed true

for wilt resistance. The work with cabbage aimed at developing cold-hardy varieties was favored by an unusually severe period of freezing weather. Three of the twenty-eight varieties under test were significantly more hardy than the others. About 400 inbred lines of sweet corn which show increasing promise for earworm resistance were selected for 1939 plantings, and new inbred lines and crosses between inbred lines of high resistance were initiated. Significant results were also obtained in the breeding work on peas, snap beans, and tomatoes.

PASTURE IMPROVEMENT

The improvement through basic research of pastures in the 12 Northeastern States is the objective of the pasture-research laboratory at State College, Pa. The program of work is designed to yield new facts and new and improved pasture plants, and to develop methods whereby they may be utilized fully through coordinated effort for the benefit of the agriculture of the region. Considerable attention was given to the strengthening of cooperative research. The problem of self-sterility, which is an important one for certain grasses and clovers, received especial emphasis, and a genetic basis for this condition was determined. Successful crosses were made between plants of perennial ryegrass and meadow fescue. Doubling of chromosomes was induced by colchicine treatments in perennial ryegrass, white clover, and red clover. Treated plants of the former had larger leaves and thicker culms, more highly soluble dry matter, and higher sugar content than untreated plants. Progress was made in determining for several grasses the effect of cold treatments, variations in length of day, intensity of light, and nutrient concentrations on growth and composition. Research on diseases of pasture plants was begun.

SOYBEAN INDUSTRIAL PRODUCTS

In its work of developing industrial uses for soybeans and soybean products the soybean industrial products laboratory has prepared 237 samples of paints, varnishes, and enamels. Weathering tests on these are under way at Urbana, Ill. Conditions for the dispersion and precipitation of soybean protein have been studied closely, and published results are finding immediate industrial use. A dispersion of soybean meal in formaldehyde has attracted much interest and has been used in developing a laminated board and a plastic with leather scrap filler. A commercial use of this dispersion as a tub size for paper is furnishing an outlet for approximately 1 ton of soybean meal daily. Considerable progress has been made in research on the stability of oils and fats, especially as to means of measuring and predicting their probable keeping quality. Other basic studies, in cooperation with the Indiana and Minnesota stations, that deal with chemical qualities and the effect of moisture content on the respiration of soybeans are yielding preliminary results of interest. The conclusions of a 3-year study of the effect of varieties and environment on chemical composition of the principal varieties of soybeans when grown in different soil types in 5 North Central States indicate that the 2 factors are of about the same magnitude. The breeding program was expanded in 1938. Cooperative uniform breeding nurs-

eries were established in 12 locations in the north-central region. Preliminary results obtained by backcrossing show that this method has promising possibilities for developing improved commercial varieties. Other work in progress includes physiological studies and correlations between available mineral constituents of the soil and composition of the seed.

SWINE-BREEDING IMPROVEMENT

The major accomplishments at the regional laboratory for the improvement of swine through breeding were the establishment of new lines of breeding animals and the expansion of buildings and other facilities. Purchase of new stock and expansion of stock made available for the project permitted the addition of 11 new lines of Poland China and 3 of Duroc Jersey. Since the amount of inbreeding necessary for improvement by means of converging lines and top crossing is not known, it is planned to check the lines from time to time as the inbreeding advances by crossing them among themselves and also in top crosses. Several matings were made for this purpose. A few inbred lines were discarded because of lack of reproduction and low livability. One inbred line averaging between 45 and 50 percent inbreeding has maintained favorable fertility, but rate of growth in this line has declined markedly and heavy losses have occurred from birth to about 180 days of age. In general, the new inbred lines have performed reasonably well in comparison with noninbreds although certain physical defects have occurred. An attempt is being made to hold these defects in check while genes for desirable characters are being fixed. The second-generation pigs from crosses of the Landrace and Tamworth breeds showed slightly more variation in score, but no more variation in other respects than an outbred population. Definite progress was made in establishing workable standards for recording and evaluating certain essential data on live animals. The herds now established under active cooperation at the Iowa, Minnesota, Mississippi, Nebraska, and Oklahoma stations include Poland China, Duroc Jersey, Tamworth, and Danish Landrace breeds. Active cooperation was initiated with the Illinois station to test the effect of selection on the rate and economy of gain in 2 lines of Hampshires, one a rapid-gain line and the other a slow-gain line.

SHEEP-BREEDING IMPROVEMENT

The breeding program of the regional laboratory for the improvement of sheep for western ranges has shown marked progress during its second year. Progeny tests were begun in September 1937, with 20 pens each consisting of 1 ram and 25 ewes. The rams represented as many different lines of breeding as it was possible to obtain. In addition, 12 breeding groups of 1 ram and 20 ewes each were made up to test young sires for heading new inbred lines. In addition to seeking to develop range sheep superior for hardiness, yield, and quality of wool, and lambs produced, noteworthy progress was obtained in certain pens where special emphasis was placed on mutton qualities, length of staple, or the open-face character. Progeny tests proved quite successful in eliminating from the breeding program rams whose offspring were inferior in mutton or wool characteristics.

Because of the importance of these progeny tests, the 1939 program included 25 additional pens. The breeding program was further strengthened by the addition of laboratory equipment for wool studies. Information of this type is basic to a sound method of selecting outstanding lines of sheep. Studies of the physiology of reproduction revealed that complete sterility of rams under conditions at Dubois was rare and that low fertility was uncommon. There was a very definite increase in fecundity of ewes with ages up to 5 years, which was also true of ewes lambing and of the percentage of live lambs born per ewe bred. A direct correlation was found between gain or loss in weight during breeding and fecundity. Minor additions to the physical plant were made.

ANIMAL-DISEASE RESEARCH

The research program of the animal-disease laboratory was initiated at the close of the last fiscal year. Coccidia were found in nearly all young cattle that were examined regularly. The heaviest infestations were observed in calves 1 to 3 months of age. Five known species of the parasite and four previously unidentified species were encountered. Experimental inoculations made with one of the latter species indicated that the prepatent period was approximately 23 days. In a study of the gastrointestinal parasites associated with coccidiosis, 16 species were encountered. Most animals between 3 and 18 months of age were found to be most seriously parasitized. No consistent relationships were found between the severity of parasitism and various soil types. Several species of nematodes survived 5 months on well-drained sandy pastures. Experimental infections in calves with *Haemonchus contortus* yielded data as to the effect of feeding on the expression of clinical symptoms. Encouraging results were obtained in efforts to find a satisfactory medium for the growth of the bacteria responsible for Johne's disease. Observations are in progress as to the reaction of guinea pigs and chicks to inoculations of this organism. The work on gastrointestinal parasites was expanded to include lungworms. The 12 cooperating experiment stations in the southeastern region are assisting the laboratory in obtaining material for the study.

POULTRY-VIABILITY IMPROVEMENT

The physical plant of the laboratory for the improvement of viability in poultry was completed and the experimental program begun with the hatching of chicks. The plant consists of a central laboratory building, brooder houses, isolation houses, laying houses, and a garage and feed-storage house. The first hatch of experimental chicks was taken off April 3, 1939, and 9 subsequent hatches each Monday thereafter. One-half of each hatch was inoculated with material from field outbreaks of fowl paralysis as the chicks attained suitable age. The memorandum of understanding between the Department and the 25 cooperating stations in the north-central and northeastern regions was completed, and the first meeting of the collaborators was held. Although the research program of the laboratory was outlined to give consideration to the management, and nutritional and pathological aspects of fowl paralysis, first attention

is being given to the development of strains of poultry of known resistance to this disease. This work will include the identification of strains of poultry with respect to resistance and susceptibility to fowl paralysis, the determination of the effectiveness of breeding for resistance and susceptibility, and the influence of egg production and other biological factors on the incidence of the disease. Accompanying the breeding phases of the program, studies are being made of the pathological changes due to fowl paralysis in the inoculated birds, and attempts are under way to develop specific methods for the diagnosis of the disease. The poultry industry, especially in the 25 States which the laboratory serves, suffers an estimated annual overhead in flock depreciation exceeding $100,000,000. No adequate methods are known that will eradicate, avoid, or control the several diseases chiefly responsible for these losses, despite an annual estimated expenditure in excess of $10,000,000 for medicines, remedies, and tonics. Any new information leading to a better understanding of the fundamental cause of low viability and to the development of effective control measures and methods of eradication should have great value.

SALINITY OF IRRIGATION WATERS

The research program of the regional laboratory for investigations of the salinity of irrigation waters is geared to the solution of important problems of large areas devoted to irrigation agriculture in the Western States and Hawaii. It was formulated during a series of conferences of directors and collaborators of the 12 cooperating Western State stations and Hawaii, with representatives of the Office of Experiment Stations and the 2 Department bureaus concerned. A thorough review of all pertinent work accomplished or in progress was used as a basis for the projects to be undertaken. The work is planned to contribute to basic knowledge concerning the tolerance of economic plants of the West to salts found in irrigation waters and soils of irrigated areas, the effect of continued irrigation on the physical nature of the soil and its productivity, the mechanism of salt injury, and the symptoms of injury resulting from excessive salt concentrations. The irrigation practices necessary to avoid harmful salt concentrations and the possibilities and limitations of drainage as a reclamation practice will also receive thorough consideration. The research greenhouses and other facilities which supplement those of the Rubidoux Laboratory made available by the University of California for the use of the Department were completed January 20, 1939. Concrete tanks to serve as sand-culture vessels for the growth of crops have been constructed at the main laboratory at Riverside and at the United States Date Garden, Indio, Calif. Other tanks are under construction at the United States Horticultural Station, La Jolla, Calif. The 3 stations, which represent decided ranges in climate from hot and dry to cold and humid, will afford opportunity for determining the effects of extremes of light, temperature, and humidity, and transpiration on the crop plants selected for study. One large-scale experiment with 10 common crops was begun late in the fiscal year.

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RELATION OF SOILS TO PLANT, ANIMAL, AND HUMAN NUTRITION

Although sponsored primarily by the experiment stations of the Northeastern States, the scope of investigations of the laboratory for research into the relation of soils to plant, animal, and human nutrition is national rather than regional. A national group of collaborators, consisting of outstanding investigators in soils research and in plant, human, and animal nutrition will advise relative to the program and conduct of the investigations. The program of the laboratory reflects a widespread interest in the effects of mineral elements of the soil derived through the medium of plants used as food and the effects of various growth substances upon the dietary reactions and the behavior and development of animals and man.

In recent years, special attention has been given to the effects on man and animals when plant or animal products, grown in certain soil areas, were used as food. There is evidence that physiological disorders are common among man and animals in certain sections of the country but do not occur in others; also, that some soils contain undesirable elements which inhibit growth of plants and adversely affect the growth of animals. The knowledge of the number of mineral elements of biological significance has increased notably, and additional and important functions have been ascribed to some elements long known to be essential. Many or all of these elements are generally supplied to the body through plants consumed as food. In past years supplies of these elements were obtained from most soils in adequate quantity for the needs of plants and for those of the animals that ate them. Reduction of these supplies, through crop removal and the opening to crop production of some new regions where soils were deficient in certain elements, has created an urgent need for research on the whole problem of the occurrence, availability, absorption, utilization, and role of the mineral elements in plant and animal nutrition and of methods of replenishing these elements and of modifying the mineral composition and growth substances of plants used for animal and human food.

A regional laboratory project in this field of investigation was approved by the Secretary early in the fiscal year, contingent upon the development of an integrated, coordinated program. Formal approval of a project which had been worked out in cooperation with the directors of the northeastern stations followed on January 31, 1939, and Cornell University, Ithaca, N. Y., was selected as the location for the laboratory as recommended by the directors. A 2¼-acre site on the campus for laboratory buildings, greenhouses, and other facilities was deeded to the Federal Government by Cornell University. The university also supplied detailed plans and specifications for the wing of the main laboratory building now under construction and will supply, at no cost to the Department, rooms for small animals to be used in the experiments.

SPECIAL RESEARCH PROJECTS

The portion of the special research fund available for special research projects was intended primarily to enable the Secretary to undertake studies basic to agriculture in its broadest aspects. The legislation provides that these research projects may be conducted by such agencies

of the Department as the Secretary may designate or establish. Many problems arise, the solution of which requires special research as a guide to further progress. This fund enables the Secretary to undertake such work as the need arises within the limitation of funds available.

One of the effective uses of the fund by the Secretary is to provide for an immediate timely study of problems which arise during the year, especially in connection with the administration of acts basic to the welfare of agriculture in its broadest aspects. Other major problems basic to agriculture in its broadest aspects require for solution the more fundamental type of research extending over longer periods of time. Both these needs have been kept in mind as far as practicable from the first in the administration of the fund. All subject-matter bureaus have cooperated with the Director of Research and the Secretary in an effort to select for research both fundamental and short-time projects on the basis of their relative importance and promise of effective results within the limit of funds. The larger portion is assigned to the more fundamental studies. Each year, however, a portion of the fund is assigned to research projects undertaken to collect much needed basic factual data in a relatively short time.

Within the 4 years during which the special research fund has been available 74 separate research projects have been under investigation. Thirty-one of these had been completed or terminated by June 30, 1939, and 43 were active on that date. Of the completed projects, 10 had been in progress for 1 year, 16 for 2 years, 2 for 3 years, and 3 for 4 years. Of the 43 projects active on June 30, 15 had been in effect for 1 year, 9 for 2 years, 2 for 3 years, and 17 for 4 years.

In accordance with the provisions of the act, after the research to be undertaken has been carefully planned and outlined in writing the project is assigned for leadership to the existing subject-matter bureau most directly concerned, with provision for cooperation from other subject-matter bureaus, State experiment stations, or other research agencies which can contribute effectively to solution of the problems involved. During the fiscal year 11 bureaus of the Department, 24 State experiment stations, and 16 other agencies have participated in the program, bringing to this program of research, as far as practicable, the best leadership and physical plant and equipment available. Under this arrangement practically the entire fund has been used for the actual special research.

The following illustrate types of projects carefully planned and undertaken to supply in relatively short time information basic to agriculture.

"ALL RISK" CROP INSURANCE

For years there had been widespread and growing interest in crop insurance. Beginning with congressional hearings on the subject in 1923, there had been repeated inquiry of the Department for information on crop insurance, and legislation on crop insurance had been proposed. Prior to 1936 the information that could be furnished was too limited to be a useful guide to proposed crop-insurance legislation. Research on a large scale had not been practicable because of the difficulty and expense of obtaining the necessary number of individual farm records. The Agricultural Adjustment Administration, in carrying out the activities prescribed by Congress, had ac-

quired by 1936 a large number of individual farm records on certain crops. At the same time, the Bureau of Agricultural Economics had undertaken work on a very small scale to determine whether the wheat-yield data included in these records could be used to determine the premium rates that would be required for insurance on this crop. When the special research fund became available, the Department immediately allotted funds for a more intensive study of these records and with this additional aid it was possible to carry the analysis far enough to indicate what seemed to be a practical basis for the establishment of crop insurance.

STORAGE OF GRAIN SORGHUM ON THE FARM

During the fiscal year the shorter-time investigations included, for example, investigation of storage of grain sorghum on the farm. Considerable thought had been given by farmers and by representatives of the Department and State colleges concerning the question of making loans on grain sorghum in the southern Great Plains area as a means of stabilizing livestock feed supplies and livestock production in that area. Recommendations that this be done had reached the Department. Meantime, some of the best qualified State and Federal workers familiar with problems of grain sorghum had advised as to probable difficulties and losses in the storing of this crop without further information as to requirements for such storage. The question itself and the amount which might be involved in loans and the probable difficulties, perhaps losses, seemed to merit such immediate action as might be taken to secure facts before the 1940 harvest season. With a relatively small amount of special research funds, a project was started about March 1, 1939, under definite plans in cooperation with State experiment stations to use facilities available and secure helpful facts before the fall harvest.

DETERIORATION OF VEGETABLE SEEDS

A study of the quick deterioration of vegetable seeds in warm humid regions, and methods for its prevention, carried to completion during the fiscal year, illustrates another type of short-time research project.

Seeds of many crops produced in the South deteriorate with extreme rapidity, giving very low germination and stand when planted only a few months after harvest. Seeds purchased elsewhere and shipped to warm and humid regions often deteriorate seriously before they can be marketed and planted. This problem is of great economic importance to seedsmen, growers, and consumers alike, all of whom have requested help from the Department in preventing or reducing losses. It is essential to know the proper conditions for preventing damaging increases in moisture content of seeds, and if high moisture content has developed it is essential to know how quickly and at what temperatures it can be reduced to a safe level without damage to the seed. Because of the need for such information and the possibilities of developing facts in a relatively short time, which would be of real economic value, a carefully outlined special research project was approved May 14, 1938. During the fiscal year 1939 the investigation was carried to completion and a manuscript was prepared and submitted for publication which will be of real help to seedsmen, growers, and consumers.

The program for the fiscal year included 10 such short-time projects planned and undertaken to be completed within 1 to 2 years. This plan of holding the smaller portion of the fund available for timely research on such problems naturally has been a major factor in developing to completion 31 of 74 projects undertaken with the special research fund since the fund became available July 1, 1935.

Of the longer-time projects basic to agriculture in its broadest aspects, 44 have been undertaken to the close of the fiscal year. Space will not permit of more than brief comment to illustrate the type of investigations undertaken.

IMPROVEMENT OF WEATHER FORECASTING

Efficiency in agricultural planning to produce the "ever normal granary" cannot in every case be as effective as is desirable because meteorological factors such as droughts, excessive rains, damaging storms, etc., may have a profound effect on agricultural production. Improved weather forecasting of short- as well as long-range character would lead to better foreknowledge of crop prospects and serve as an important aid in agricultural planning. The basic importance of extending knowledge of the behavior of weather was recognized in the establishment of investigations under special research funds by the Department in cooperation with several leading educational institutions. The work has been conducted along two lines—(1) a critical appraisal of existing methods of short- and long-range weather forecasting from both a statistical and physical basis, and (2) the inauguration of fundamental research in meteorology designed to furnish an understanding of weather essential to the development of practical methods of long-range forecasting.

The appraisal of existing methods of forecasting has been completed and has indicated the probability that the method of Dr. Franz Baur can be adapted for 5- and 10-day forecasts in America. A study of charts of the Northern Hemisphere and of observed meteorological conditions has suggested certain relations which have been used as a basis for formulating empirical forecasting rules. These have been applied with some success.

Studies of the physical processes involved in the development of cold waves in North America have been concerned with the enlargement of certain theoretical concepts of the formation of large masses of cold air in northern Canada and Alaska. In order to verify these concepts, upper air observations by airplane and radiosonde balloons were conducted at Fairbanks, Alaska, and, through cooperation of the Canadian Government, at Fort Smith, Canada. The results of these studies have led to a fairly complete understanding of the method of formation of cold air streams from which principles have been evolved leading to more accurate forecasts of the southward sweep of cold air masses. A better understanding of summer weather has been attained through the use of the isentropic chart which gives a representation of both horizontal and vertical air flow. By means of this chart and analyses based on airplane and radiosonde observations, it has been demonstrated that the circulation in the upper atmosphere has more of an eddying character than was heretofore supposed. A promising beginning has, therefore, been made in improving the accuracy and extending the range of forecasts of summer as well as winter weather conditions.

Although much remains to be learned in the complex field of weather behavior, the studies made possible by the special research fund have already contributed considerable new data of a fundamental character.

GRAIN STORAGE ON THE FARM

The ever-normal-granary, crop-loan, and crop-insurance programs have emphasized the need for complete and accurate information regarding the deterioration of grain under various storage conditions, both on the farm and in commercial-type elevators. Better storage facilities on the farm would aid growers in marketing their grain crops to advantage, in reducing losses from deterioration, and in securing credit on stored grain. The information needed includes the types of storage structures that will best preserve and improve quality, the maximum moisture content for safe storage for various periods, the development of effective methods for reducing moisture content, and the part played by micro-organisms in the deterioration of stored grains.

In order to collect information which might have practical value over a wide area, a study was organized under special research funds in which three bureaus of the Department and seven State experiment stations cooperated. The study has developed the fact that the moisture content of wheat is the most important factor in storage, the practical safe upper limit being less than 14 percent for farm storage for 1 year of wheat to be milled into bread flour. A lower moisture content is desirable for longer storage. Wheat for seed should have a moisture content several percent lower if storage for more than 1 year is contemplated. The spoilage of wheat of high moisture content is associated with the presence of fungi and bacteria and attempts to hold these organisms in check with chemical treatments were not fully satisfactory. Drying of moist wheat seems to be the most feasible control of spoilage.

Under conditions of low atmospheric humidity such as were found in North Dakota and Kansas, satisfactory drying of grain in bins was obtained by forced ventilation, and in favorable years wheat of 15 to 16 percent moisture content was kept in good condition in bins having good natural ventilation. In Illinois drying by natural ventilation was unsatisfactory, and forced ventilation only fairly satisfactory in most years and not dependable in wet years. Because of the prevailing high humidity in Maryland neither natural nor forced ventilation was successful in reducing moisture content. Since excessive moisture content of wheat sometimes cannot be avoided because of weather conditions, portable grain driers are being developed and tested. Observations are being continued on about 12,500 bushels of wheat from the 1936, 1937, and 1938 crops to determine rates of deterioration under various storage conditions for extended periods of time. The storage bins range in capacity from 20 to more than 1,000 bushels.

EFFECTS OF LIGHT FOR DIFFERENT LENGTH PERIODS UPON GROWTH AND REPRODUCTION OF PLANTS

Our knowledge of the striking effects of the length of day and night upon the growth and reproduction of plants has been acquired through research of the past 20 years. Some species and varieties respond to long days, others to short days, and still others are capable

of responding to various lengths of day. The interrelations between the length of day and the temperature of the winter season largely control successful reproduction in many species and their ability to survive in given regions. The relation between length of day and time of flowering is of great importance in crop yields.

More complete knowledge of the effect of different periods of light upon plants would permit of many practical applications in plant improvement and production for the different sections of the country. The greenhouse industry involving many millions of dollars uses supplemental lighting to advantage in producing flowers at the time of greater demand. Plants from other parts of the world which normally do not flower and set seed under our conditions can be made to do so under controlled illumination and thus be made available for breeding to improve our commercial plants. New varieties and strains of promise can be tested under controlled conditions at a central point and their adaptability for use in different sections of the country determined speedily and at greatly reduced cost as compared with the field trials heretofore necessary.

Basic research undertaken by the Department in this field is designed to contribute fundamental knowledge of wide practical application and make other phases of the plant research program more productive.

ENZYME ACTION AT LOW TEMPERATURES

Until a few years ago, it was considered impossible for any noteworthy change through enzyme action to take place in food products at temperatures much below freezing. Experience in the operation of cold-storage warehouses has indicated, however, that some enzyme actions do take place at low temperatures, and that these actions are important in the preservation of foods for extended periods. A longer preservation from spoilage of cold-storage foods would serve important national interests by helping to equalize wide fluctuations in production with steady consumer demand. The long preservation of foods is also of major importance in national defense. These considerations, together with the rapid recent development of cold-storage lockers for family use and the large interests involved in the operation of commercial storages, seemed to warrant a thorough inquiry into the subject of spoilage through enzyme action.

The Department's work to date under special research funds has resulted in the discovery and isolation in pure form of enzymes which tend to accelerate decomposition of animal fats and proteins in cold storage. These enzymes can now be studied more effectively and accurately. They include a new protein-digesting enzyme from beefsteak, a previously unknown enzyme of the esterase group from the muscle of beef, and a fat-digesting enzyme. The latter does not decompose all fats at the same speed at low temperatures, thus indicating a relation between the diet of the animal and the stability of the meat. The action of these enzymes indicates that lower storage temperatures for meat are desirable.

A further product of the study has been the isolation of the enzyme papain in pure crystalline form and the development of a method for its extraction from the whole plant of the papaya rather than the fruit alone. Papain is used in medicine and has recently

come into extensive use in tenderizing meat. The cleanliness and quality of the imported product now employed should be greatly improved through technical developments in drying and storage which have been discovered in the work, and leaf papain from Hawaii could replace imported material if the necessity should arise.

THE UTILIZATION OF FARM PRODUCTS REGIONAL LABORATORIES

Under the provisions of section 202 of the Agricultural Adjustment Act of 1938, the Secretary of Agriculture was authorized—

> to establish, equip, and maintain four regional research laboratories, one in each major farm producing area, and, at such laboratories, to conduct researches into and to develop new scientific, chemical, and technical uses and new and extended markets and outlets for farm commodities.

Public, No. 644, Seventy-fifth Congress, an act making appropriations for the Department of Agriculture and for the Farm Credit Administration for the fiscal year ending June 30, 1939, provided that—

> not to exceed $100,000 shall be available under the provisions of section 202 (a) to 202 (e), inclusive, of said act to conduct a survey to determine the location of said laboratories and the scope of the investigations to be made and to coordinate the research work now being carried on.

In accordance with this legislation and the assignment of responsibility by the Secretary for the development and continuous coordination of the Department's research program for the laboratories, the Director of Research and Chief of the Office, with members of the staff, has participated in deliberations and recommendations concerning (1) the delineation of major producing areas and their farm commodities which have continued in surplus, (2) the preparation of tentative major research objectives for the laboratories and arrangement for their joint consideration by research representation of the four regions and the Department of Agriculture, (3) the survey of related research in the Department and other Federal agencies, the State experiment stations, educational institutions, privately endowed research institutions, consulting laboratories, and industrial laboratories, (4) assembling facts bearing upon the advantages of several hundred proposed laboratory locations, and (5) considerations of the scope of research to be undertaken in the laboratory program, and suggested principles of coordinating the research of the laboratories with each other, with active work in the Department and elsewhere. The work and accomplishments of the year are detailed in the Secretary's report to Congress published as Senate Document 65, Seventy-sixth Congress, first session.

COORDINATION OF RESEARCH

The Chief of the Office, as Director of Research, acts as a central authority in the Department to promote cooperation in the planning and coordination of research, both within the Department and with the States, and with other agencies participating in agricultural research. Assistance in developing and coordinating the research program of the Department was accomplished through advising with bureau chiefs and the Secretary; through over-all and individual

project budget considerations; and through other activities including cooperation with bureaus in consideration of appeals from interested people and agencies for help through research.

The coordination of the research of the Department and that of the State and Territorial experiment stations was promoted through assisting departmental agencies in developing the most effective cooperation with one or more stations, on the one hand, and through assisting the stations in obtaining scientific advice and suggestions as well as active cooperative help from the Department. Aside from a vast amount of assistance rendered informally, the Office examined, approved, and recorded nearly 1,400 new or revised formal memoranda of understanding covering cooperative research between bureaus of the Department and the stations, and involving over 1,000 major research undertakings. All of the State experiment stations and all but one of the research bureaus of the Department participated in this program. While these net figures do not suggest a substantial increase in formal cooperation over the previous year, the numbers of new undertakings and of undertakings brought to successful completion during the year were higher than ever before. In addition, there was again much informal cooperation between organized regional and national groups of stations and, in some cases, between such groups and the Department. Such informal cooperation is essential to, and often precedes, the organization of formal cooperative research, particularly that affecting the more specialized phases of agricultural production and rural life involved in the action and adjustment programs as these have progressed and become more definitely focused.

The State experiment stations again worked with other State agencies and local organized groups, with each other in regional groups, and with the Department individually and in regional and national groups, in efforts to coordinate their research, especially on such adjustment and action program problems as land-use planning and adjustment. Efforts were continued to focus studies begun on an emergency basis as recovery measures during previous years, on the practical aspects of a permanent economically adjusted agriculture. Over 50 specific phases of the national study of adjustments in farming by regions and type-of-farming areas were continued in 26 States with the cooperation of the Agricultural Adjustment Administration, Bureau of Agricultural Economics, Farm Security Administration, and Soil Conservation Service. Similar work was completed in 9 other States during the year, bringing the total of States which have completed this study to 22. This synthesis of available agricultural information was being crystallized rapidly and refocused under modified and improved techniques into a concentrated attack on the national problem of land-use planning to meet long-time requirements of a permanently adjusted agriculture.

For the new regional laboratory established during the year under the provisions of the Bankhead-Jones Act, and discussed elsewhere in this report, the memorandum of understanding entered into by the Department and the experiment stations concerned provided as usual for integration of research at the laboratory with research at the experiment stations in the region and for joint annual review and revi-

sion of the research program. This memorandum of understanding covering a laboratory for study into the relation of soils to plant, animal, and human nutrition provides specifically for coordination of the plans and work on this subject at 12 experiment stations in the northeastern region with those of 4 bureaus of the Department. It is significant that the directors of the 12 northeastern experiment stations in recommending the establishment of a laboratory to work on this problem also recommended that the work be conducted from a national standpoint.

In this connection it is of interest that one of the regional cooperative projects among the experiment stations, the study of variations in the composition of vegetable foods grown in different areas of the South, deals with a segment of the broad program of research to be undertaken by the new regional laboratory. This project now actively in progress in six of the Southern State stations, under memoranda of agreement by the directors of the stations involved, is providing worthwhile coordination between regional and national aspects of the problem.

Typical of the cooperative research into broad regional or national problems, initiated under the provision of the Bankhead-Jones Act for research by the Department other than at regional laboratories, was the investigation of farm storage of corn. This investigation, which has been in progress for 2 years, involves the work of five Department bureaus and four State experiment stations.

Cooperative research relating to land-use planning was being organized on a national basis as an important phase of an agricultural land-use program which will involve cooperation of farmers, State extension services and experiment stations, the Bureau of Agricultural Economics, and action and operating agencies of the Department. This program will deal with agricultural adjustment, conservation, crop insurance, farm forestry, flood control, land retirement, rehabilitation, water utilization, and other factors that affect land use, and is designed to supplant gradually the national study of agricultural adjustment mentioned previously, which in its present form has largely served its purpose and is being rapidly brought to completion. By the end of the year 28 States had signed formal cooperative documents covering this undertaking.

The over-all memorandum of understanding covering research relationships between the Soil Conservation Service and the State experiment stations continued to be effective with 47 stations. Under this over-all agreement 17 State stations were cooperating with the Soil Conservation Service and the Bureau of Agricultural Economics in a study to determine the economic and social effects on farms resulting from the operation of a definitely planned program of soil conservation. Cooperative hydrologic investigations were in effect in 6 States, and 4 State stations were conducting studies of superior vegetation for hill-culture purposes. In addition, there were 51 separate cooperative studies in 34 States dealing with other phases of erosion control. The cooperative exploratory study of soil erosion begun the previous year was continued in the 6 New England States.

The cooperative efforts at crop improvement and in the development of cost-saving production methods were continued and focused along the more productive lines indicated by previous studies. The cereal-crop-improvement investigations again included 21 States, the

cooperative breeding and cultural studies of potatoes included 22 States, and the corn improvement, forage crop, and grass breeding and improvement investigations involved 7, 10, and 11 stations, respectively. The forage-crop work was completed in 7 States and the corn-improvement work in 8 States. The investigations on production, improvement, and diseases of cotton were continued in 12 States. Cooperative investigations of machinery for the mechanical application of fertilizers to cotton, sugar beets, and canning crops, also for the production and harvesting of sugar beets, corn, and cotton, and for the control of weeds were continued in 11 States. Investigations on the mechanical application of fertilizers to potatoes were completed in 5 States. The cooperative soil survey was continued in 28 States during the year, and the work was completed in 8 States. The investigations of concentrated fertilizers involved 11 States and 2 bureaus of the Department, and the work was completed in 4 States. Studies on the relation of the conformation and anatomy of the dairy cow were extended to include 12 State stations, and investigations of parasites of the oriental fruit moth were extended to 12 stations. Cooperative work on cereal and forage-crop insects were continued in 9 States, and the work was completed in 20.

The cooperative western-range-survey agreement, covering 7 regions and involving 14 State stations, 4 Department bureaus, and the Division of Grazing and the Bureau of Indian Affairs of the Department of the Interior, was renewed for various periods with the different stations. The study of input as related to output in milk production was continued with 2 Department bureaus and 10 State stations cooperating. The type-of-farming study was continued in 9 States, and the work was reported as completed in 20. The estimate of farm population and of farm-population movements was extended to 13 States, and the study of quality and palatability of meat was continued in 9 States, the work being reported as completed in 22.

Increasing recognition of the importance of good nutrition to the health and well-being of human beings and of the needs for more satisfactory standards for optimum in contrast to adequate nutrition gives further emphasis to the value of the several regional cooperative projects dealing with different phases of the nutritional well-being of young women of college age. The north-central cooperative project on the nutritional status of college women entered the fourth year of the original 5-year plan with a sufficient accumulation of data on anthropometric measurements, basal metabolism, formed elements of the blood, and dietary balances to warrant preliminary analyses. These analyses involve many comparisons which would not have been possible but for the fact that identical methods have been used in the six different institutions represented in the study. Nor would it have been possible in any one institution to have accumulated sufficient data in this length of time to warrant the general treatment of the pooled data now possible. The value of coordination of effort is also seen in the joint attack upon problems of technique which inevitably appear during the course of an extensive investigation.

Similar advantages are becoming evident in the regional project on ascorbic acid metabolism of college students which has completed its second year as a cooperative project participated in by five stations in the Northwest. In this project identical methods are being

followed in a survey of the ascorbic acid metabolism of college students on their customary diets, and in addition each station has been assigned a particular problem in methodology on which to concentrate and report at the annual conference of project leaders. Effective coordination of this project with a similar though less extensive project in the Northeast has been brought about through the application of the exact methods of determining the saturation requirements for vitamin C developed by one of the northeastern group. In this way, with less effort and in a much shorter time sufficient data will be accumulated to establish general conclusions concerning the vitamin C requirement of this age group.

The cooperative textile project in the Northeast dealing with performance during wear of women's and children's wearing-apparel fabrics, in which 6 States are participating, completed its third year. To date about 700 fabrics have been analyzed, and a few of the worn-out garments have been inspected. This project is providing a means of assembling a large amount of data on the types of women's and children's wearing-apparel fabrics on the market and the value of laboratory tests as a means of predicting actual wear. Perhaps even more important is the fact that because of the magnitude of the project sufficient analyses have been made within 2 years to supply the Federal Trade Commission with data helpful in the establishment of trade-practice rulings concerning the shrinkage of woven cotton fabrics and concerning rayon fabrics. In both instances rulings favorable to the consumer have been adopted.

In numerous other regional and national studies of a long-time character the Department cooperated with various groups of experiment stations. The total number of formal agreements covering cooperative research ranged from 9 to 59 per station.

PUBLICATIONS

The principal publications of the year included official reports dealing with the work of the Office, and the work and expenditures of the State agricultural experiment stations; reports and bulletins of the Puerto Rico Experiment Station; and publications designed primarily to promote efficiency in the work of the stations and to aid in coordinating research among the stations and between the stations and the Department.

Of first importance among the latter group, Experiment Station Record was continued as an epitome of progress and results of current scientific research carried on by the experiment stations, the Department, and other agencies for the improvement of agriculture and rural life. Volumes 79 and 80 were completed, but, because of the increase in printing rates discussed in last year's report, 1 entire issue of 144 pages was omitted and 4 others were curtailed 16 pages each. The total number of printed pages was thereby reduced in volume 79 to 720 and in volume 80 to 864, making a total of 1,584. This was a shrinkage of 12 percent from the 1,800-page limit established and maintained without interruption since 1911. The total number of abstracts published in the 2 volumes was 6,746 (2,975 in volume 79 and 3,771 in volume 80), a decrease of 472, or 6.5 percent, from the previous year. With this decrease, the problem of adequately covering the literature in the space available, which the steady expansion of research agencies has

been rendering increasingly difficult for several years, was correspondingly aggravated. Although, under prevailing conditions, full coverage is given to the technical publications of the stations and the Department, including those published in scientific journals, material from other sources is necessarily subjected to an increasingly rigid selection, and much of value is omitted.

The annual revision of the list of workers in subjects pertaining to agriculture in land-grant colleges and experiment stations, the list of station publications received by the Office during the year [mimeographed], and a revision of the publication dealing with Federal legislation, rulings, and regulations affecting the stations were also issued as informatory, coordinative, and administrative aids.

The list of articles and Department publications written by members of the staff of the Office or under its supervision and issued during the fiscal year follows:

Report of the Chief of the Office of Experiment Stations, 1938, by James T. Jardine.

Report on the Agricultural Experiment Stations, 1937, by J. T. Jardine, W. H. Beal, et al.

Report on the Agricultural Experiment Stations, 1938, by J. T. Jardine, F. D. Fromme, et al.

Workers in Subjects Pertaining to Agriculture in Land-Grant Colleges and Experiment Stations, 1938–39, by Mary A. Agnew. U. S. Dept. Agr. Misc. Pub. 335.

Federal Legislation, Rulings, and Regulations Affecting the State Agricultural Experiment Stations. U. S. Dept. Agr. Misc. Pub. 348.

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The report of the Hawaii Agricultural Experiment Station for 1939 was reviewed by this Office for publication in Hawaii.

LIBRARY AND BIBLIOGRAPHIC SERVICE

The library of the Office, in cooperation with the Department Library and the Extension Service, continued to maintain its files of the publications of the stations, the United States Department of Agriculture, and the extension services of the State colleges.

The 2,742 publications of the stations and the Department of Agriculture current for the year were collected and prepared for the use of the Office staff including abstracting in Experiment Station Record. From the publications received by the Department Library 2,955 books and 22,637 periodicals were selected for circulation in the Office of Experiment Stations and the Extension Service. Many of these were examined for experimental and research data and submitted for review in the Record.

The ninth supplement to Department Bulletin 1199, a list of station bulletins published in 1937–38, was prepared and sent to the printer. Work on the index to the station bulletins published prior to 1923 was continued so as to make available a complete indexed list of the bulletins issued from the organization of the stations through 1930, for which there is increasing demand.

Lists of contributions by station workers appearing in current scientific journals were compiled and published monthly in Agricultural Library Notes, as were also the monthly lists of the State extension publications. From 100 periodicals and scientific society proceedings examined, 3,290 titles by station workers were listed, including 72 from the Journal of Agricultural Research contributed by 29 stations. Lists of current station publications were compiled monthly and distributed in mimeographed form to agricultural colleges, stations, libraries, other institutions, and selected individuals. The files of station publications were consulted by workers throughout the Department. Bibliographical data and short lists on specific subjects were compiled, and publications were supplied in answer to requests. Other work accomplished included the preparation and filing of 21,271 index cards in all catalogs in the library and the binding of 319 volumes of station and Department publications for the Office and for the Puerto Rico Station. In addition to permanent binding, 103 volumes were placed in temporary binders.

U. S. GOVERNMENT PRINTING OFFICE: 1939

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LEADERS ON THE LAND

A Report of Cooperative Extension Work in Agriculture and Home Economics in 1939

EXTENSION SERVICE
WASHINGTON, D. C.
UNITED STATES DEPARTMENT OF AGRICULTURE

A People With a Vision

PROGRESS is achieved through leaders who envision better ways of life and make their fellow men so conscious of those ideals that together they make their dreams come true. From such visions, extension work was born. Its pioneers dreamed of a sound family farm life for the America of their children and their children's children. The movement they created has kept alive that vision.

Its purpose is still the same as these men conceived it—the development of individual initiative among the men and women who have clung to the soil of America. For true rural progress must be achieved by advancement in the thinking and habits of farm people. It is not sufficient that terraces be built; they must be maintained in the years that follow or they may eventually become a menace rather than a benefit. It is not sufficient that food be canned; it must be served in properly balanced menus if the family health is to be maintained. It is not sufficient that 4–H Clubs be organized, they must interest and inspire rural youth for year after year if their true purpose is to be realized. It is not sufficient that farmers learn more efficient methods of production, they must understand the economic factors that determine profit or loss for agriculture as a whole if their goal of more satisfactory living is to be achieved.

Extension work, constantly inspired by farm people and constantly aiding those farm people to add knowledge and action to that inspiration, is assisting rural America to make today's dreams realities and tomorrow's visions more glorious.

LEADERS ON THE LAND

A REPORT OF COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS IN 1939

PREPARED BY THE EXTENSION SERVICE

C. W. WARBURTON, Director

REUBEN BRIGHAM, Assistant Director

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Farming Goes Forward

Farming is a way of life. Beyond the elevators, the commodity exchanges, the packing plants, and the produce terminals that feed the Nation's farm products into the channels of commerce are families that live on the land—families whose food, clothing, shelter, recreation, education, and health depend upon what the land provides. Family farming is a traditional feature of American agriculture.

That tradition—with its constant goal of improved farm-family living—faced painful new problems as 1939 concluded an eventful agricultural decade. Increasing mechanization of farming, increasing numbers of large commercial farms, declining soil fertility, and reduced demand for farm labor were rapidly increasing the pressure of the population on the land. Reduced foreign markets for farm products caused repeated piling up of crop surpluses. Limited buying power in the hands of city consumers held prices for farm products at low levels.

The farmer saw a ghost—the specter of poverty in the midst of plenty.

More than 1,700,000 farm families have an average income of less than $500 a year, including all that they grow for themselves. This means about 8½ million persons trying to struggle along on an average income of approximately $2 a week each.

Six hundred thousand farm families live on land so poor that under present use and organization they have no adequate economic security.

Four hundred thousand farm families live on land of indifferent quality and suffer from insufficient acreage.

The working farm population is now growing at the rate of about 445,000 a year, and the increase is fastest in those very areas which already are poorest and most overcrowded.

Because of increased mechanization of agriculture and reduced foreign markets for farm products, today it is possible for this Nation to meet all the normal requirements of farm production, both foreign and domestic, with 1,600,000 fewer farm workers than were needed 10 years ago.

Yet it appears that agriculture will have to support at least as many people on farms during the next 10 or 15 years as are now living on farms.

Erosion has caused the loss of from one-third to three-fourths of the topsoil from more than 663 million acres of land. This wastage of the earth costs 400 million dollars a year. It also is rapidly reducing future opportunities in agriculture.

Faced with these unpleasant but unavoidable facts, the Nation's agriculture in 1939 increased its efforts to make life more satisfying and more secure for the families on the land.

Ten trends of American agriculture stand out in the records of cooperative extension work for the year. Soil conservation is the headline. Throughout the country, a general realization of the dangers of continued erosion and soil depletion and a growing determination to do something about the problem were reflected in a changed pattern of farm operations.

Great increase in conservation

Seedings of such soil-conserving crops as alfalfa, clovers, grasses, and winter legumes showed substantial increases. A shift from traditional straight-row farming to the curving, level lines of contour farming was evident. Planting of cover crops to protect and tie down the shifting soil of the windswept Great Plains gained popularity. Planting of trees—in windbreaks, shelterbelts, and erosion control areas—exceeded all previous records.

With payments under the Nation-wide agricultural conservation program and the impressive demonstrations of the Soil Conservation Service adding impetus to the conservation teachings which extension work has carried on for years, the Nation's agriculture achieved progress toward wiser use of its basic resource—the land.

Increased attention to soil conservation brought larger acreages of pasture and forage crops. Farm animals furnish virtually the only profitable use for hay, pasture, and fodder crops, and this fact brought the livestock industry and its leaders increasing responsibility in connection with major agricultural planning and conservation activities.

More attention to livestock

Modified feeding and grazing practices were developed in the extension animal husbandry programs of many States to meet the new economy of increased pasture and forage. Farm-management specialists and agronomists played an important part in assisting the farmers of the Nation to fit a changing pattern. Dairymen were aided in adapting their feeding systems in line with the increased acreages of high-quality legume hays put up and the improved pastures available. Use of grass and legume silage showed a marked increase. Decreased purchases of concentrate feeds and a reduced percentage of protein in the grain ration fed dairy cows also resulted.

Good seed is a vital factor in getting more land into grass and legumes and out of soil-depleting crops. In fact, almost all phases of the extension agronomy program center around and are dependent upon it.

Seed improvement shows progress

Definite efforts to develop better seed supplies were undertaken through organized seed-improvement programs in 38 States in 1939. In Oregon, work was begun with the cooperation of the A. A. A. to subsidize the production of winter legume seed that moves into the Southern States, for the winter legume-seed program in the South is one of the vital factors in soil conservation and improvement.

Emphasis on seed improvement also resulted from the passage of the new Federal Seed Act, which provides for the safeguarding of the interstate movement of certified and registered seed, beginning in 1940, and places definite responsibility on State seed-improvement associations. Conducting demonstrations of the value of new and improved crop varieties, stressing their adaptability, yields, quality, and disease and insect resistance, continued to be an important phase of extension work.

Growing determination to remedy past mistakes in land use found a practical outlet through local and State land use planning committees. Approximately 70,000 farmers in 1,120 counties formally took part in land use planning work in 1939 as members of local committees. Approximately 200,000 other farmers also took part in planning activities. Extension workers contributed heavily to the development and guidance of this planning work.

Farmers develop land use plans

Planning activities produced practical and definite results. Rather than being confined to mere outlining of desirable but unattainable goals, the planning committees laid concrete proposals before local and national agencies that could take immediate steps toward making the plans become realities. During the last 6 months of 1939 there were more than 700 recorded instances of action of one kind or another growing out of the land use planning program in 445 counties in 38 States.

Reinforced by the movement toward greater conservation of soil and wiser use of land, there was a noticeable return to the habits of thrift in home production and storage of food that characterized pioneer America. Feeling the continued pinch of low farm income and realizing the need for better diets, farm families turned with renewed vigor to the age-old tasks of gardening, canning, and butchering. Scientific food plans, based upon the dietary needs of the family, were widely adopted. Giving a modern twist to the ancient habits of family food storage was a great extension of freezer-locker facilities.

Return to home food planning

These locker plants have shown a phenomenal growth as farm families have endeavored to protect their dinner tables from the inadequacy of cash income. In 1939 more than 2,200 locker plants, most of them less than 5 years old, were operating in 40 States. Extension specialists in nutrition and animal husbandry held meetings with plant managers and with farm people to assist in developing the most desirable use of these plants in preserving meats, fruits, and vegetables—rich in vitamins and minerals—for use in those seasons when farm diets are likely to be monotonous and lacking in these protective foods.

Increased numbers of farm families in 1939 adopted the practice of planning ahead to obtain the food supply needed for good nutrition throughout the year. Likewise, a growing number of homemakers kept records of amounts and cost of foods purchased, and others also recorded the amount and value of foods used from the farm. Raising a family poultry flock to supply a more adequate diet was encouraged by popularizing home-made equipment and simple flock-management systems.

The coming of electricity to the farm home is listed in more than half the county extension workers' reports as one of the year's outstanding achievements in better housing. Cooperating with the Rural Electrification Administration and commercial agencies, these extension workers made available to farm families knowledge on how to select lighting fixtures, where outlets should be placed, and similar problems, and helped families with their financial plans for electricity.

Electricity great housing improvement.

Consumer education meetings by the hundred helped farm families get their money's worth when buying the new refrigerator, electric iron, toaster, or radio.

The attention to electricity supplemented routine home-improvement teachings, such as furniture refinishing, furniture arrangement, planning of storage space for the work center, and similar topics.

State extension services continued to assist farm families in drawing plans for new homes. Arkansas, which has conducted "better homes" campaigns for 15 years, centered its 1939 campaign on low-cost housing and the use of home materials and labor by the farm family. More than 2,000 new dwellings were constructed in the State at a saving of $648,000 for labor and materials, and more than 3,000 homes were remodeled.

Develop program for older youth.

Young people constitute the most important product of American farms. Fifty-one percent of the Nation's children are country born and raised. Throughout its history, extension work has contributed to the upbuilding of this human resource—the Nation's farm youth. More than 8 million boys and girls have taken part in the 4–H Club program since it became Nation-wide in 1914. In recent years, extension programs have devoted increased attention to the problems of older rural youth, the problems of young people beyond 4–H Club age who are seeking a livelihood at a time when opportunities for employment in the cities are limited and agriculture does not need increased numbers of farmers.

Every year at least 200,000 young men become farm operators on their own account for the first time and an equal number of young women become the wives of farmers. Every year more than a million farm people, mostly under 30 years of age, leave the farm and move to towns and cities. Many of them later return. To meet the problems of this group more effectively, extension services in many States have sponsored special clubs for young people above 4–H Club age, special short courses of training in fields of interest to this group, studies to determine what social and economic topics are of most concern to these maturing young people, and similar activities. In 1939 there were 2,073 extension-organized clubs for rural young men and women over 16 with 71,700 members. Programs of these organizations showed a definite trend toward more study of timely and pertinent economic information along with recreation and social activities.

Progress was recorded in steps to benefit farm children below 4–H Club age. Extension workers and local nutrition leaders in every State endeavored to enroll more mothers of young children in community or special home demonstration groups. They worked with parent-teacher associations and cooperated with nurses and social workers and others.

Several States sponsored or took part in well-child clinics. Arkansas increased the number of better-babies clubs, developed some 10 years ago as auxiliaries of local home demonstration clubs, and Alabama organized such clubs for the first time.

A growing demand from rural people for help in child development and family relationship problems also was reflected in reports of extension workers. To meet this need, training on the subject was given extension workers in many areas. Several States employed specialists in this field.

In 1939, as in almost every year since 1914, the Nation found need for fast, efficient, widespread action to meet agricultural emergencies.

Extension meets farm emergencies.

Extreme drought in the Great Plains and many sections of the West; war abroad and uncertainties as to the price outlook for many commodities; the partial collapse of the tobacco markets; and other similar events forced farmers in many areas to make adjustments quickly in light of the best information that could be marshaled. The Extension Service, with a representative on the ground in all areas in close touch with farm people, and with State and national organizations, was able to move rapidly into action in these emergencies—as it did in the days of the World War.

Such response to emergency situations has been called for almost every year since extension work was founded. War, droughts, floods, hurricanes, the boll weevil, grasshoppers, and similar plagues have required extension people to cooperate with relief agencies in rehabilitating stranded families and feeding undernourished children; to help with conserving food, feed, and equipment; to give counsel on cheap yet adequate diets; and to aid in the maintenance of morale through increased recreation, social life, emergency employment, handicraft work, and like benefits. Extension efficiency in meeting such emergencies has increased through the years. Larger staffs of State and county workers have facilitated the problem of spreading information to farm people throughout the United States quickly and accurately and have made it possible to obtain prompt, complete, and accurate reports of conditions in the Nation's agricultural areas whenever necessary. County agricultural agents are now at work in all counties of agricultural importance, while only three-fourths of the counties had agents at the height of the last war.

Twenty-five million acres of crops were saved by a grasshopper control campaign on which extension entomologists in 14 Western States spent much of their time in 1939. Using 154,000 tons of poisoned bait provided by the Federal Government, more than 235,000 farmers protected their land from grasshopper ravages. Estimates by county agents and extension entomologists indicate that each dollar spent for grasshopper control saved $52 worth of crops.

Each dollar spent saves $52.

The grasshopper campaign illustrates the fact that although newer responsibilities have added to the duties of extension workers in recent years, their first and fundamental task of assisting farm people to farm more efficiently has not been neglected. Year after year, demonstrations of ways to improve crop yields, speed livestock gains, control insects and diseases that cause crop losses, and improve management methods have returned dividends far in excess of the cost of extension work.

Local appropriations to support extension work showed significant increases in 1939, indicating that the cooperative extension program—after 25 years of service to the rural United States—still is increasing in popularity among the people whom it serves.

Build for still greater service.

Approximately 44 percent of the total cost of extension work was met through State and local funds. Of a total appropriation of $33,000,000 for all cooperative extension work, about $18,000,000

came from Federal grants to the States through the United States Department of Agriculture, about $6,660,000 from State funds, about $6,845,000 from county appropriations, and about $941,000 from farm organizations. The cost of the Federal Extension office was about $800,000. Nearly 4,600,000 farm families were influenced by some phase of the Extension Service program in 1939. Every part of farm life and every type of farm family was covered in that program.

The extension organization, consisting of almost 9,000 employees, has one or more workers in every important agricultural county in the United States, Alaska, Hawaii, and Puerto Rico, supported by a corps of subject-matter specialists, administrative officers, and supervisors located in the Department of Agriculture and at each of the land-grant colleges. There were 2,932 county agricultural agents and 979 assistant agents on June 30, 1939. Their work was supervised by 167 district agents and 24 county agent leaders. In addition, there were 1,792 county home demonstration agents and 168 assistants; 285 county 4–H Club agents and 56 assistants; 256 Negro agricultural agents and 210 Negro home demonstration agents; and 2 Negro county 4–H Club agents. The work of this total county personnel of 6,680 was reinforced by a corps of 1,551 agricultural and home economics specialists.

The work of these members of the extension staff was supplemented by the activity of more than 600,000 volunteer leaders—farm men and women whose interest in improved farm living is so great that they donate a portion of their time each year to spreading information among their neighbors.

To meet more effectively its responsibilities of assisting farm people in understanding new Federal and State programs for agricultural improvement, the Federal office of the Extension Service was reorganized on February 1, 1939. Functions and activities which have in recent years assumed primary importance in the work of the service were realined under five main heads: Office of the Director; Division of Business Administration, M. M. Thayer, Chief; Division of Field Coordination, H. W. Hochbaum, Chief; Division of Subject Matter, J. W. Boatman, Chief; and Division of Extension Information, Reuben Brigham, Acting Chief. The reorganization served to assist State and county workers in providing farm people with a rapid service of information about national farm programs and also encouraged greater effectiveness and accomplishment in older lines of extension work.

Science for the Farmer

Characteristic of the American farmer is his continual search for new methods of husbandry that will increase his income from the land.

Constant quest for efficiency.

New machines, new crops, new tillage methods that reduce labor, cut production costs, or eliminate hazards have been quickly adopted whenever discovered. The steel plow and the reaper swept across the country, displacing methods that were centuries old. The tractor is rapidly replacing the horse, and the combine harvester-thresher is outmoding the threshing machine and the binder.

This readiness to adopt new methods has brought tremendous increases in the producing power of the farm worker. One estimate is that from 1870 to 1930 the average output per agricultural worker in

the United States increased about 140 percent. Another estimate indicates that the production per agricultural worker increased about 20 percent during the 20 years from 1919 through 1938.

Throughout its history, extension work has aided the quest for efficiency by bringing farmers the latest information developed through scientific tests at agricultural experiment stations. That phase of extension work continued to be of tremendous importance in 1939, with increased emphasis being given the economic and social aspects of agricultural advancement. Particular attention was devoted to informing farm people of the services available through the government "action" programs inaugurated in recent years and to guiding farm people in using these programs to achieve permanent agricultural improvement. These new tools for achieving long-standing objectives have given the Nation's farm families opportunities for important progress.

Extension aids with new ideas.

Farmers' accomplishments in adoption of measures to reduce soil-erosion damage and safeguard soil fertility exceeded all previous records in 1939, stimulated by programs of the Agricultural Adjustment Administration and the Soil Conservation Service. Contour farming was practiced by 230,881 farmers on 9,957,600 acres, according to county agricultural agents, an increase of nearly 50 percent above the 1938 acreage. More than 3,000,000 acres of land were both terraced and contour farmed. Seedings of legumes and grasses were increased, and considerable acreages of land unsuited to cultivation were retired to grass or trees. One hundred fifty-six soil-conservation districts had been set up in 25 States by the end of the year to aid in united community action for land protection.

Save soil and water.

Extension workers in all States continued to promote soil-conservation activities through meetings, demonstrations, news articles, and circular letters, as well as during countless farm visits and office calls. Of especial importance was the time devoted to familiarizing farm people with the opportunities for farm improvement available under the programs of the Agricultural Adjustment Administration and the Soil Conservation Service. Throughout the Nation, county agents and extension specialists inspired farm people to use these "action" programs in ways that would be of lasting benefit to the land.

State examples of notable progress in soil improvement as a result of extension activities are numerous. Approximately 3½ million tons of lime materials were made available to Wisconsin farmers during the last 5 years through the efforts of county extension agents and specialists of the College of Agriculture of the University of Wisconsin. In 1939 the output of agricultural lime was stimulated through the establishment of W. P. A. lime-grinding projects in cooperation with county extension service organizations. It is estimated that nearly 6 million acres of acid soils in that State need the application of lime.

In Greeley County, Kans., practicing of strip cropping and cover cropping has decreased the acreage subject to wind erosion from 270,000 acres in 1936–37 to less than 5,000 acres in 1939. Under a program that had the united support of the local extension organization, the county A. A. A. committee, and the county land use planning committee, the acreage of strip cropping to control wind erosion

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increased from 30,000 in 1936 to 150,000 in 1939, summer fallow increased from 15,000 to 75,000 acres, contour farming from 6,250 to 30,000 acres, pasture contour furrowing from 480 to 3,100 acres, and terracing from 80 to 1,050 acres. Wheat seedings decreased, and row crop acreages increased. Livestock was brought into the county as farmers turned from one-crop wheat farming to diversified agriculture. Sheep increased from 580 head in 1936 to 3,357 in 1939. Cattle increased from 1,994 to 3,165; hogs from 182 to 382; poultry from 6,780 to 9,212. In addition, large numbers of stock were brought into the county for wintering. Deposits of the local bank reflect the effect of this trend toward diversified agriculture. Deposits on June 30, 1935, were $147,504. Each succeeding year recorded an increase. Deposits on June 30, 1939, were $200,832.

In Missouri, the extension service gave organized leadership training in all phases of soil conservation to 700 men in 37 counties in 1939. These men will provide complete soil conservation demonstrations, assist their neighbors with the technical features of building terraces, contouring, and gully control, and will organize lime-crushing programs and serve as soil conservation leaders for 4–H clubs. The acreage of Missouri land farmed on the contour increased 100 percent during 1939. The State's legume acreage increased from approximately 2½ million acres in 1930 to nearly 7 million acres in 1939. The original extension goal of placing 25 percent of the State's cropland in legumes already has been exceeded, and the present goal is for one-half of the crop acreage as well as much of the pasture land to include legumes.

The lespedeza project instituted by the Kentucky extension service a decade ago covered about 7 million acres in 1939, and the beneficial presence of this soil-improving crop was a noticeable feature of the landscape.

The acreage of crested wheatgrass seeded on wheat lands in Oregon increased by 40,000 acres during 1939, bringing the total for the State—largely in wheat-producing counties—to 140,000 acres. More than one-third of the wheat land of the State was devoted to trashy summer fallow in 1939, a practice which is reducing the soil losses from wind and water erosion that formerly resulted from clean summer fallow.

In 661 counties, mainly in the West and the South, extension agents aided farmers to improve their irrigation practices. Farmers in more than 1,000 counties were assisted in the drainage of 1 million acres of land.

Lay plans for wise land use.

Tremendous losses have been suffered by the Nation as a result of unwise use of land. Erosion has destroyed valuable topsoil. Fire and faulty management have ruined vast forest tracts. Overgrazing and grazing at the wrong seasons have weakened the stand of grass on extension range areas. Families have suffered as a result. Poor schools, poor roads, poor diets, and lowered standards of living have followed exploitation of natural resources.

Extension workers have long been conducting educational programs directing the attention of individual farmers and the general public to these consequences of faulty land use and have been sponsoring measures to correct them. Land-use tours, land-use exhibits at public gatherings, addresses at public meetings, printed bulletins, and news

articles have been used to focus interest on the problem and inspire action to correct it. Local group discussions have been held with farmers taking part to appraise the problems of their local areas, the adjustments needed, the ways in which these adjustments might be speeded up with the least economic and social loss, and the probable effects upon farm people living in distressed areas. Work has been carried on with public officials regarding the proper handling of natural resources under their administration.

Such educational activities were given further impetus by extension workers in 1939 through their participation in land-use planning work sponsored jointly by the Department of Agriculture and the land-grant colleges. Formally organized planning committees functioned in 1,120 counties during the year. Approximately 70,000 farmers were members of these committees, and 200,000 other farmers took part in planning activities. Rural women took an active part in land use planning in Vermont, Utah, Oregon, Delaware, Texas, Louisiana, and several other States.

Community, county, and State committees of farm men and women were organized. These committees—after they had mapped local land-use situations and studied land-use needs and possible readjustments—in cooperation with representatives of the State agricultural colleges and the Department of Agriculture, made recommendations for the correlation and localization of the national programs in terms of land use and in types of farming which can relieve local problems. This planning involves not only the determination of adjustments significant for the individual farmer but also policies of public importance, such as the land use zoning or land classification, which as carried on in Wisconsin and New York, has resulted in the withdrawal of huge acreages from farming.

Land use planning in 1939 progressed beyond the stage of theory and discussion. The groundwork was laid for translating the recommendations of farmer committees into specific action. Teton County, Mont., provides an example of the widely varied forms of action that can be taken as a result of farmer-drawn land use plans.

One of the major problems mapped by the Teton County land use planning committee was the designation of 20,000 acres of plow land that was unsuitable for crops and should be used for grazing. As a result of the committee's recommendation that this land should be returned to grass, steps for accomplishing a part of the shift in 1940 were agreed upon by several Federal, State, and local agencies concerned with land use in that area.

The county A. A. A. committee agreed to encourage retiring low-grade lands from cultivation and reseeding them to grass; not to allow any low-grade sod lands to come into the A. A. A. program as cropland; to make an annual report to the county assessor of low-grade sod lands broken up during the year; to place emphasis on deferred grazing under the range program; and to use land classification data as a guide in determining productivity indexes.

The Farm Security Administration agreed not to make loans for the purpose of cropping low-grade plow and grazing lands; to attempt to get such lands into their recommended uses wherever controlled by Farm Security Administration clients; to assist in increasing the size of farming units that are definitely too small; and to assist in organizing livestock units in the poor areas of the county.

The Farm Credit Administration agreed to make a special effort in Teton County to assist in increasing the size of farming units now definitely too small; and to give careful consideration to the productivity of lands before extending loans.

The State land department agreed to discourage the breaking up of low-grade sod and abandoned farm lands under its control; to endeavor to get its low-grade farm lands back to grass to be used solely for grazing purposes; and to encourage reseeding by charging a lower rental for such lands if the renter reseeded them to grass.

Teton County officials agreed to complete reclassification of lands and to check early work for assessment purposes to correlate it with the latest information; to assess at a higher rate any low-grade lands which are being cultivated or which are broken up for cropping purposes; to give a grazing classification to low-grade plow lands that are now in sod or are abandoned, and to assess them accordingly; to make every effort to correct misuse of low-grade county-owned lands; and to start in 1940 to study further the relation of land values to productivity so as to improve the tax system.

The county extension agent agreed to prepare a program to assist in obtaining the recommended adjustments in land use and to place special emphasis upon informing nonresident landowners regarding the land classification and planning work of the county so that they may be better informed as to the values and best uses of lands under their control.

Similar coordinated campaigns of action were developed to carry out other recommendations of the land-use planning committee, dealing with water utilization and development, erosion control, weed control, rodent and insect control, and range management.

In Bowman County, N. Dak., where close cooperation in the land use planning program has been given by the county governing board, the county government actually has realized direct revenue through adjustments in land use put into effect. State legislation permits the county government to lease land taken for taxes. Designations of grazing and agricultural land made by the local land use committee have guided Bowman County to the extent that revenue from leases is being realized on land that for many years had returned no tax income. At the same time, land unfit for agricultural crop production is being kept in grass, and ranchers are now able to stabilize their operations. Adjustment of land use as a basis for sound agriculture is the primary program of the North Dakota Extension Service.

Ohio stressed land use planning through the medium of 228 individual farm demonstrations in 36 counties. After an intensive study of each farm, a 5-year plan was developed by means of which the farmer can attain a "productivity balance" through shifts in the cropping pattern, livestock production, labor power, equipment, and storage facilities so as to achieve a maximum net-income-producing capacity and a more satisfying life.

Seed improvement progress shown.

The need for larger supplies of good seed is the Nation's number one agronomy problem. In 1939, there were 38 States with organized seed-improvement programs. Extension crops specialists and county agents assisted in many States with the organization of the inspection and certification of seed supplies, gave advice on seed production and handling methods,

and consulted with farmers concerning crop varieties for which more satisfactory seed supplies were most needed.

An example of the results accomplished is provided by the Oregon small-seed industry, an extension project of 10 years' standing which continued to expand in 1939. A primary purpose of the program is to shift from production of such bulky commodities as wheat and small grains to products of concentrated value which can stand the high costs of shipping long distances. Income to Oregon farmers from production of small seed in 1939 approximated 6 million dollars, nearly 6 percent of the State's annual income, compared with only $200,000 a few years ago. New kinds of seed, developed by agricultural research and carried into production on farms in the State by the Extension Service, played an important part in this development. Chewing's fescue, alfalfa, Alsike clover, Ladino clover, and Austrian field peas were among the kinds of seed showing large increases in 1939.

The one-variety cotton program continued to expand in the Southern States, proving of great value in enabling farmers to get a good price for their improved cotton. Approximately 13,000 Louisiana farmers, who produced about 150,000 bales of cotton, were members of 125 one-variety cotton community organizations during 1939. During the last 10 years, educational work among cotton growers of the State has reduced the number of cotton varieties grown from more than 100 to about 10. In 1939 approximately 85 percent of the cotton acreage of the State was of only one, pure variety.

Cotton variety interest growing.

In Texas, 415 one-variety cotton community associations were in operation in 1939 as contrasted with only 62 in 1937. These associations included more than 27,000 farmers and nearly a million acres of cotton, almost 11 percent of the total cotton acreage of the State. New Mexico had 23 one-variety cotton organizations, including nearly 91,000 acres—approximately 92 percent of the cotton acreage of the State.

More than 4,200 cotton gin stands were put in improved mechanical condition through extension assistance and advice. Conditioning of cotton in dryers was greatly increased, an important step in improving ginning methods.

The ever-present problem of reducing losses from plant diseases that lower yields and quality of farm crops was given attention by extension agents and specialists in all States. Assistance was given in identifying plant troubles and control recommendations were demonstrated and publicized.

Crop disease control pays large dividends.

Seed treatment benefited cotton growers of North Carolina to the extent of more than $5,500,000 in 1939. In a total of 191 cottonseed-treatment demonstrations conducted during the 1936–39 seasons by the North Carolina Extension Service, the value of lint and seed from the treated seed averaged $9.82 per acre more than the value of lint and seed from untreated seed. The acreage of cotton planted with treated seed increased from 7,000 in 1935 to 600,000 acres in 1939. Results from 19 cottonseed-treatment demonstrations in Virginia showed an increase of 28.2 percent in the yield per acre, amounting to an increase of $11.95 per acre in the value of cotton. It is conservatively estimated that about 90 percent of the cotton growers in that State practiced seed treatment in 1939.

The custom cleaning and treating of seed wheat and other seed grain progressed during the year in Indiana, Illinois, California, Pennsylvania, and other States. In Indiana, 40 portable cleaning and treating outfits cleaned 413,961 bushels, or 17.7 percent of the seed wheat sown in the State, and treated 148,659 bushels. In Illinois, 24 such portable machines handled approximately 300,000 bushels of seed wheat in the fall of 1939 in addition to more than 100,000 bushels of oats and barley cleaned in the spring. Reports from farmers substantiated experimental results which have shown that treating seed not only increases yields but also improves the quality of the grain.

The development and distribution of new and improved disease-resistant varieties of cereals in recent years has made small-grain production a less hazardous business. Thatcher wheat provides an example. Spring wheat in Minnesota and the Dakotas has suffered enormous periodic losses from stem rust in years past. Thatcher, a rust-resistant variety, was developed in 1934. By 1939 it had become so widely used that 42 percent of the spring wheat acreage was sown with it, 5,524,631 acres in all. Other rust-resistant spring wheats also gained in popularity.

In Kansas, Oklahoma, and parts of Texas, seedings of the rust-resistant winter wheat, Tenmarq, increased from less than 200,000 acres in 1934 to more than 3,500,000 acres in 1939.

The introduction and spread of such resistant varieties as Rex, Hymar, and Oro has contributed greatly to the remarkable decrease in losses from smut or bunt in the Pacific Northwest. About half a million acres were seeded with Rex and Hymar in 1939. Neither of these wheats was grown 5 years earlier.

The acreage of smut-resistant and rust-resistant varieties of oats also has increased rapidly in recent years.

Extension meetings, demonstrations, and bulletins have been of great importance in informing grain growers of these new varieties.

Control of orchard and vegetable diseases showed marked results in 1939. In Pennsylvania, apple spraying increased yields from 6½ bushels of unmarketable fruit on unsprayed trees to an average of 21 bushels of high-quality fruit on sprayed trees. Tomato growers in four counties were assisted in producing 5,500,000 tomato plants that were entirely free from collar rot, whereas nearly one-fourth of the plants from other sources were infected with this disease. Formaldehyde seed treatment of potatoes reduced scab from 23 to 12 percent and increased yields 25 bushels an acre. Eighteen result demonstrations on potato spraying showed a gain of 92 bushels an acre from spraying. The 5-year-average gain from spraying in Pennsylvania is 101 bushels an acre, and the average cost of spraying has been 15 to 16 cents a bushel.

The development of the certified seed potato business in Minnesota has been a direct result of extension educational work on potato disease control. Approximately 9,900 acres of potatoes met the required standards in 1939, producing 1,350,000 bushels of certified seed which sold on the average for 25 cents per 100 pounds more than the same grade of table stock. Three thousand acres of foundation stock was produced, which should bring an extra premium.

Demonstration of recently developed methods of controlling blue mold of tobacco was a major project in most tobacco States. In

North Carolina, the results of 60 demonstrations showed that about 10,000 more plants were pulled from 100 square yards of treated bed than from the same area of untreated bed.

Most outstanding among the insect-control accomplishments of 1939 was the grasshopper-control program administered by the Bureau of Entomology and Plant Quarantine. Extension entomologists in 14 States spent much of their time on this program, in which 25,000,000 areas of crops were saved by the application of 154,000 tons of poisoned bait furnished by the Federal Government. Farmers also were assisted in protecting their crops from numerous other perennial insect pests, including blister beetles, wireworms, cutworms, white grubs, hessian fly, chinch bugs, cotton boll weevil, and fleahoppers.

Cut losses from insects.

South Carolina farmers demonstrated that higher yields of cotton can be produced even under conditions favorable for the boll weevil. Although heavy initial emergence was reported at the Pee Dee station in late May and weather conditions through the summer were more favorable for weevil damage than usual, nevertheless the State's yield averaged 342 pounds of lint cotton to the acre—one of the largest yields per acre in its history. One practice which contributed to this high yield was widespread early poisoning for boll weevil. County agents' reports show that 1,105,596 gallons of molasses were used by farmers as an ingredient in a recommended poisoned bait mixture—almost enough material to make two applications of early poison to one-half the cotton planted in the State.

Control of orchard insects—always a factor of major importance in the commercial fruit-producing areas—likewise received attention. In Pennsylvania, where the codling moth situation is not so serious as in some sections, growers who followed the advice of the extension entomologists produced 31.6 percent more clean fruit than those who did not spray.

In the Corn Belt and the southern Wheat Belt, extension entomologists advised farmers concerning control of insects in stored grain. A large increase in farm storage of grain in these areas has resulted from the Government ever-normal granary program of loans on wheat and corn. Lending agencies and local A. A. A. committees united with extension workers in encouraging prompt and effective fumigation of all stored grain threatened by insect damage. The value of their efforts is indicated by the relatively light damage to grain by insects despite the large amount of farm-stored grain and the favorable conditions for insect breeding which prevailed.

Protect stored grain supplies.

Farmers in 1939 showed a greater concern about burned and depleted woodlands, reforesting of idle lands, and marketing of timber products. As a result, there were substantial increases in the number of State extension forestry specialists employed and the number of States cooperating in the extension forestry program. According to county agricultural agents, educational work relating to farm forests was conducted in 2,164 of the 3,070 counties in the Nation.

Farmers concerned about woodlands.

County agents and extension foresters cooperated in the distribution of trees to farmers and conducted demonstrations to show how to care for and plant young trees. Records of the Forest Service

show that farm distribution of planting stock in 1939 by cooperating States totaled approximately 63 million trees. Most of these were used for erosion control, for production of fence posts, pulpwood, saw timber, and naval stores, and for shelterbelt protection for farmsteads and field crops. Extension records for the year indicate that 31,985 farmers were assisted in planting windbreaks and shelterbelts and 25,906 were aided in planting trees for erosion control. New York and Georgia were among the leading States in farm forest-tree planting.

Approximately 55,000 acres were planted to trees under the provisions of the agricultural conservation program, which has stimulated interest in retiring idle and low-grade farm lands to trees. Extension foresters conducted special training work for A. A. A. county committeemen in many States to assist them in acquainting farmers with the use of the tree-planting and tree-maintenance provisions of the program.

During the year 36,224 farmers made improved thinning and weedings in cooperation with extension agents, and 41,384 practiced selection cutting, thus increasing farm income through better woodland management.

Forest-fire prevention, marketing of farm forest products, improved practices in production of naval stores, and practices for production of higher quality maple sugar and sirup were among the other forestry topics covered in the extension program. New emphasis was given utilization of farm-produced timber for construction of buildings through such work as the "home-made homes" project carried out by the Arkansas Extension Service and cooperative sawmill projects in Texas.

Efforts to improve production methods and income from farm animals acquired new importance in 1939 with the growing realization among agricultural leaders that the livestock industry holds a key to progress in land use planning. Farm animals furnish the market for most of the corn, hay, barley, oats, and grain sorghums produced in the Nation, as well as providing the only profitable use for about 1½ billion acres of pasture and range land. Increased acreages of soil-conserving crops, such as grasses and legumes, resulting from the Nation-wide emphasis on conservation of soil resources, depend upon livestock for successful utilization. For that reason, extension workers in 1939 devoted much time to the interpretation of planning programs in terms of livestock production practices and enlisted the aid of animal husbandry leaders in the organization and operation of major project activities.

Livestock important in land use planning.

The Nebraska pasture-forage-livestock program provides an example of the coordination thus accomplished. This program, which has been carried on for 5 years, emphasizes these eight objectives: Maintaining proper livestock-forage balance; restoring drought-injured grasslands; returning unproductive cropland to grass; increasing the acreage of soil-building crops; producing heavy yields of high quality roughages; utilizing forage crops profitably; building up feed reserves; and encouraging livestock production on rented farms. Through this program, the use of sorghums for fodder, ensilage, and grain has been popularized to the extent that approximately 2 million acres were planted in 1939 as compared to a normal of about 200,000 acres.

Sixteen hundred farmers cooperated in the program in 1939, and 9,004 people interested in livestock attended the 28 meetings held.

During 1939, extension workers in all sections of the country gave special attention to the problem of the most efficient utilization of the greater production of forage resulting from increased interest in soil conservation. Modified feeding and grazing practices to meet the new economy were incorporated in many programs of work. An example is the feeding of whole alfalfa hay to hogs, a practice which is becoming increasingly popular on Illinois farms. Farmers of this State also demonstrated methods for grazing cattle on land withdrawn from production of cash crops under the A. A. A. program. A Pike County demonstrator, for example, used oats and sweetclover for pasturing yearling steers getting a full feed of shelled corn and soybean meal.

Soil conserving crops modify feeding methods.

Tuberculosis of cattle has been practically eliminated from the continental United States, with the exception of five California counties, and from Puerto Rico and the Virgin Islands. Only two relatively small areas in Texas and in Florida harbor cattle fever ticks. More than 11 million cattle are under supervision in the national program of Bang's disease eradication, and results indicate that rapid progress may be made in the control and eradication of this disease within the next 10 years if present financial support and cooperation are continued.

Guard farm animal health

As a result of vigorous control measures, carcasses sterilized and condemned on account of tuberculosis in hogs slaughtered under Federal inspection in the United States decreased from 0.41 percent in 1917 to 0.06 percent in 1939. The incidence of tuberculosis among breeding cattle tested decreased from 3.2 percent in 1917 to 0.5 percent in 1939, and the percentage of the cattle slaughtered under Federal inspection that were sterilized and condemned for tuberculosis decreased from 0.53 percent in 1917 to 0.03 percent in 1939. Human tuberculosis of animal origin has been significantly reduced as a result. The human death rate from respiratory tuberculosis was 124.6 per 100,000 population in 1917. It had dropped to 48.9 per 100,000 population in 1938, and the death rate from other forms of tuberculosis decreased from 22.5 to 4.3 deaths per 100,000 during the same period.

In all these animal health programs, extension workers have taken an important part. In cooperation with the Bureau of Animal Industry and State agencies, they have aroused farmer interest in disease eradication, arranged local schedules for testing of herds and flocks, and provided farmers with information concerning requirements of Federal, State, and local regulations pertaining to animal health.

Horse bots were controlled by 5,285 Kansas farmers in 1939 through the cooperation of the extension veterinarian, local veterinarians, and the educational work of the extension entomologist. More than 2,000 horses were treated for bots during a 13-day extension-sponsored campaign in Alcorn County, Miss. Nearly 31,000 horses were treated by Nebraska farmers during the winter of 1938–39. Similar campaigns were conducted in many other States.

The McLean County system of swine sanitation, first demonstrated upon the fall pigs of G. C. Johnstone, Bloomington, Ill., in 1919, has

provided marked advantages for swine growers throughout the Nation since that time. The system enabled farmers to raise their usual number of pigs from three-fourths the usual number of sows, reduced the number of runts, speeded the rate of gain, and reduced the amount of feed required per 100 pounds of gain. It is estimated that fully half of the Illinois 1939 pig crop was raised under recommended methods of sanitation, making a saving of over $9,000,000 for the farmers of this one State. Variations of this system, adapted to local needs, were encouraged by extension workers in virtually all swine-producing areas of the country in 1939.

Poultrymen in all 48 States, Hawaii, and Puerto Rico received information and assistance from specially trained workers through the county extension organization. The 1939 poultry program included modern marketing and merchandising methods as well as recommendations for efficient production. Poultry's place in supplying a cash crop was emphasized as a feature of land use planning. Popularization of home-made equipment and simple flock-management systems encouraged raising home family flocks to supply a more adequate diet.

Efficient poultry methods taught.

Demonstration farm flocks, which provide economic data and also serve as practical demonstrations, continued to be a fundamental part of the extension educational program. Approximately 4,500 such flocks are listed in extension records for the year. That the demonstration farm flock method has been effective in increasing the efficiency of poultry production is indicated by Missouri records which show that the average annual production per hen in demonstration flocks of that State increased from approximately 125 eggs in 1920 to approximately 150 eggs in 1939.

Extension workers distributed information concerning the National Poultry Improvement Plan, which is enabling producers throughout the country to eliminate disease and improve the quality of their birds. By the end of the year, 42,591 flocks with 8,653,568 birds and 2,033 hatcheries with a 75,782,922 egg capacity in 44 States were enrolled in the plan.

Testing for pullorum disease control reached a new high of more than 6½ million breeding birds in 44 States in 1939. The effectiveness of this work is indicated by the fact that the percentage of reactors among birds tested declined from approximately 6 percent in 1931 to less than 4 percent in 1939 despite a tremendous increase in the number of birds tested. Extension energies also made important contributions to the Seventh World's Poultry Congress in Cleveland, Ohio, which attracted an attendance of nearly 750,000.

The turkey industry has undergone rapid expansion in the past few years, and extension workers have been active in promoting "Grow Healthy Poults" campaigns and working with breeders in turkey-improvement associations and cooperative hatching-egg associations. When the turkey crop reached 32,000,000 birds, as it did in 1939, revised marketing methods, such as cooperative pools, were found advantageous. The use of Government grades for dressed birds was encouraged, and numerous killing and grading demonstration schools were held. In the 1939–40 season more than 35 million pounds of turkeys were graded according to United States specifications. This is an increase from 18 million pounds in the 1938–39 season.

Increase dairy efficiency.

Increased consumer buying power and favorable prices for dairy products after midsummer made 1939 a year of definite improvement for the dairy farmers of the Nation, and these improving economic conditions brought increased interest in extension educational activities. Increasing his efficiency is the dairyman's greatest opportunity for improvement, and measures for greater efficiency in production of dairy products continued to be widely adopted in 1939. Close cooperation with the agricultural conservation program and the Soil Conservation Service resulted in marked increases in the grasslands on dairy farms. More high-quality legume hays were put up; pastures were improved by reseeding, liming, fertilizing, and careful grazing management; increased acreages of temporary pastures were seeded and utilized to fill in during the short seasons of permanent pastures; and there were marked increases in the use of grass and legume silage.

The greater amounts of roughages available enabled dairymen to decrease the amounts of purchased concentrates and still maintain milk production. Meetings on dairy feeding and management were conducted by extension workers in many States. In Pennsylvania 250 such meetings were attended by 5,000 dairymen, many of whom reworked rations to save $4 to $8 in cash outlay per ton of grain fed.

Improvement of the breeding stock of dairy herds was an important project in most States. The production-transmitting qualities of more than 2,200 sires were proved during the year through dairy-herd improvement association work in 41 States, and an effort was made to keep all superior sires in service. County agents assisted 18,868 farmers in obtaining purebred sires. Cooperative use of high-class sires was brought about in 27 States through cooperative bull associations. Artificial insemination associations operated in 16 States to extend the benefits of outstanding sires. Three percent of the dairy cows in New Jersey were bred artificially. This State, which started the first artificial dairy breeding association in the United States in 1938, had five associations by the end of 1939, with 5,000 cows enrolled.

Improvement of dairy-management methods through record-keeping associations continued to expand. Seventy-two new dairy-herd improvement associations were organized, bringing the total to 1,300 in 48 States and 2 Territories, with 27,948 members having 676,141 cows on test. In a majority of States, regular farm accounts were kept by the association members and other dairymen and were summarized and analyzed at the end of the year. Demonstration of improved breeding, feeding, and management methods through associations has influenced many dairymen to adopt better practices.

In New York the average production of all cows enrolled in these associations is now 315 pounds of butterfat a year, as compared with only 261 pounds of butterfat in 1922. The 50,000 cows on test in Pennsylvania dairy-herd improvement associations produce milk at a cost about 75 cents per 100 pounds lower than the average cows in the State.

Extension workers cooperated with regulatory officials in informing dairymen on the importance of disease control.

Improvement in quality of dairy products was accomplished through extension contacts with both producers and manufacturers. Among the results of the quality improvement program were the building or

remodeling of 9,863 dairy buildings for greater sanitation and installation of numerous coolers and sterilizers.

Farm machinery is steadily increasing in importance to the American farmer. More tractors were purchased in 1937 alone than were in use on all the farms in the Nation in 1920. Combine harvester-threshers and many other types of equipment have shown great increases. The total investment in machinery on farms in the United States in 1939 was approximately 3 billion dollars. Care and maintenance of this mechanized equipment is vital, both to prolong the life of the equipment and to insure that farming operations can be carried out at the right time with a minimum of delay from breakdowns. Extension workers in 1939 assisted more than 76,700 farmers by providing information concerning maintenance and repair of machines. By following extension recommendations, these farmers saved approximately $814,000.

Teach maintenance of farm machines.

Farm people have received more training in the economics of agriculture during the last 7 years than during any similar period in the past. The accumulation of crop and livestock surpluses brought forcibly to the attention of farm people the necessity for better understanding of the economic forces determining profit or loss for agriculture as a whole. As a result, there was a tremendous increase in requests for extension workers to provide information concerning the market outlook for farm commodities and the prospects for profit from different farm enterprises. Information on foreign trade, industrial production, and income of American consumers also found a ready audience.

Keep Nation informed of economic outlook.

Extension workers throughout the Nation continued to provide such information during 1939. Many States issued monthly publications of timely economic information which were distributed to request mailing lists of thousands of farm families. Weekly newspaper columns of economic material were distributed by some State extension services. Several States presented weekly radio programs of timely economic information. Extension economists from 45 States attended a national outlook conference in Washington, D. C., where comprehensive forecasts of conditions during the coming year were drafted, and took the lead in disseminating this information to farm people throughout their States.

Evident progress was accomplished in coordinating economic information with projects for teaching improved production practices. Beef tours to view such recommended practices as creep feeding of calves also presented information on the market outlook for the classes of cattle observed. Poultry meetings included discussions of the supply and demand prospects for poultry and eggs as well as suggestions for improved feeding and housing. Increased emphasis was given economic information at 4–H Club meetings and meetings of older rural youth.

In New York, home demonstration agents were supplied market-information letters shortly before State-grown products were due to appear on the market in large quantities. Information was sent out regarding butter, cherries, apples, peaches, summer vegetables, and in the fall about cauliflower and squash surpluses. Home demonstra-

tion agents informed the public about these products through radio talks and newspaper articles, and by distributing recipes giving new uses of the seasonal products.

In 1939 a total of 82,779 farmers kept farm accounts under the supervision of county extension agents. By means of these accounts and a large number of farm-management surveys, recommendations were made to individual farmers and homemakers for adjustments in farm business and farm and home budgets, which will aid in raising the income of farm people.

Farm accounts guide improved management.

Farm and home unit demonstrations are a relatively new phase of extension teaching aimed at a better standard of living on the farm through wiser management of the entire farming enterprise. A long-time farm and home plan is prepared for each farm for the year providing for better land use, erosion control, planned crop rotations, diversified farming, soil improvement, a more adequate family food budget, home improvement and beautification, and budgets and account records of business and family living. The demonstrations are set up on a long-time basis to provide examples of the benefits of careful farm and home planning in their relation to the economic and social welfare of the farmer.

Unit demonstrations effective new method.

Texas has about 400 of these unit demonstrations, that are intended to help the family develop a practical, progressive example of improved farm management and homemaking and to demonstrate the results for the benefit of the community. A study of 1938 records for 239 of these demonstrations showed that the average yield of cotton on these demonstration farms was 186 pounds of lint per acre, as compared to a county average of 152 pounds and an average production of 128 pounds for the communities in which the demonstration farms were located. Wheat yields were 12.6 bushels per acre on the demonstration farms as compared to 9.8 bushels for the county and 9 bushels for the immediate community. Oat production was 33.3 bushels, compared with 26.5 bushels for the community and 25 bushels in the county. Corn produced 23.7 bushels for the demonstrators, compared with 17.3 bushels for the community and 17.7 bushels for the county. The demonstrators' dairy cows produced 227 pounds of fat per cow as compared to 219 pounds for the average of the county. Sows on the farms of demonstrators produced more pigs per litter than the county average, and hens on these farms exceeded the county average in egg production. Better farming, better stock, and better feeding were responsible.

Such farm and home unit demonstrations were conducted in six Southern States in 1939 with highly satisfactory results, and an extension of this teaching method to new areas is indicated for the years ahead.

Approximately 1,400,000 farmers in about 20,000 communities were given assistance in marketing by extension workers in 1939. These farmers, through cooperative associations and as individuals, sold farm products valued at more than $525,000,000 and purchased nearly $75,000,000 worth of farm supplies. About 75 percent of this total business was done by cooperative organizations. An important part of extension work in marketing was devoted to assistance and guidance in improvement

Farmers assisted in marketing.

of varieties and quality of products to be sold; grading, standardization, packing, labeling, and otherwise preparing the products for market; furnishing current market information; and considering the time of selling in relation to market prices and competition from other areas. In addition, the principles of marketing and factors affecting costs of distribution received serious consideration in the general extension marketing program.

Cooperatives benefit from extension advice.

More than 7,500 cooperative organizations with a membership of approximately 900,000 received extension assistance during the year in such varied forms as training schools and short courses, organization procedure for new associations, advice in the solving of business-management and operation problems, membership-information campaigns, and promotion of cooperative councils. In a few States, assistance was given consumer cooperatives as well as farmers' organizations.

Assistance given marketing programs.

Extension workers assisted with marketing agreements and the purchase and diversion programs sponsored by the Department of Agriculture and the Federal Surplus Commodities Corporation by explaining the programs to producers, conducting referenda, and assembling research material to be presented at public hearings. The Service also assisted such industry groups as the Northeastern Vegetable and Potato Council in the development of programs for certain commodities, leading to more efficient production and marketing practices.

Service given farm tenants.

Increased attention to farm-tenancy problems has been noticeable in extension work during recent years. In 1939 activities in this field included special landlord-tenant conferences, preparation of printed material on satisfactory leasing arrangements, providing lease forms suited to different types and systems of farming, and cooperating with State tenancy commissions, planning boards, and research departments in gathering facts pertaining to tenancy problems and arousing public interest in those problems.

In Oklahoma, a landlord-tenant relationship committee, set up by the State legislature in 1937, completed its work in 1939 and transferred its data to the extension division of the Oklahoma Agricultural and Mechanical College. Forty-three of the 77 county agents in the State were active in promoting landlord-tenant work, sending out questionnaires to tenants, holding meetings, and selecting demonstrators. In Le Flore County alone it was estimated that 100 landlords and tenants were influenced toward more equitable and longer terms of tenure. One owner of 17 farms in the county was so impressed with the possibilities of better cooperation between landlords and tenants that he held a luncheon for all his tenants to obtain their suggestions for improvement.

Thousands aided to self-support.

More than 23,400 farm families on relief were assisted by extension agents to become self-supporting in 1939, and additional large numbers were benefited through extension cooperation with representatives of the Farm Security Administration and other agencies working with low-income families. Two hundred and sixty-three thousand farmers were assisted in obtaining credit.

Extension efforts to develop a better understanding of the problems of rural taxation and rural government were continued in 1939. Facts concerning problems relating to property taxes, income taxes, taxes for specified local services, and the relation of the assessment systems to the income-producing capacity of different local areas were assembled and disseminated. At the request of the local taxpayer groups, extension workers presented facts concerning the costs of local government and the possibility of decreasing those costs through consolidation of local governmental units. In a few States, consolidation of minor governmental civil divisions resulted from extension educational work with local people.

Aid studies of taxation.

Educational work in connection with the various public programs for improving agricultural conditions occupied a large share of the time of county extension agents in 1939. Such activities included both explaining provisions of the programs to the general public and also training of local committeemen and others assigned the responsibility of administering the various programs. Equally important was the guidance given by extension workers in assembling local recommendations and information on specific problems as a basis for the development of local, regional, and national programs.

Extension advises action programs.

By means of tours, general meetings, circular letters, and training schools for committeemen, materials were presented demonstrating the economic values of certain practices related to soil conservation, soil improvement, productive forest husbandry, and the like, with emphasis on the when, where, and why of the various practices as well as how to put them into effect economically. Adjustments in farm organizations needed to promote the broad objectives of programs and also the soundest possible individual farm economy were explained, with emphasis on the relationship between farm income and the size, production, efficiency, and balance of the individual farm.

Educational exhibits prepared by the Agricultural Exhibits Section of the Federal Extension Service were displayed at 58 fairs and expositions in 1939 with a total attendance estimated at more than 10 million persons. Twenty-one new exhibits were built during the year, 17 of which were planned to further conservation practices and the national farm program. The Exhibits Section, which supervises all exhibit work of the Department of Agriculture, cooperated with several States and with other Government agencies in the preparation of exhibits during the year and planned, produced, displayed, and managed the entire Federal exhibit at the World's Poultry Congress — the largest Government display ever prepared on any one subject.

Educational exhibits viewed by 10 million.

During the past 25 years, the Department of Agriculture has presented information on better ways of farming and on a more abundant home life to farmers and the general public at more than 1,500 fairs, expositions, and other exhibition occasions having a total attendance estimated to be about 200 million people.

In early days, Government agencies expended much exhibit energy in telling the public about their functions, but as early as 1921 the Department of Agriculture commenced presenting instead useful information about new and better ways of growing crops, handling

livestock, and improving the home. Since then the standard applied in considering subjects for exhibits has been the usefulness of the facts to farmers and the general public.

Distribute many films and bulletins.

The Federal Extension Service distributed nearly 30,000 educational film strips and more than 4 million Department of Agriculture bulletins and discussion pamphlets in 1939, filling requests from State extension offices and other educational agencies. Requests for both bulletins and film strips were much greater than in previous years. Eighty-three thousand copies of extension circulars and other mimeographed material were distributed. The Extension Service Review, monthly house organ for extension field workers, was built around the central theme of land use planning during the year and did much to keep all extension workers informed of methods being successfully used by fellow workers in the various States.

Prepare 37 new motion pictures.

Approximately 7,900,000 people saw United States Department of Agriculture motion pictures at more than 53,300 showings during 1939. The fact that requests for more than 6,500 films had to be refused because prints were not available indicated the great popularity of this educational service.

Preparation and distribution of these pictures is a responsibility of the Extension Service. Films from the extension motion-picture library are lent without charge for educational use, and educational agencies are permitted to purchase copies of these films at cost. Nearly 1,360 such copies were purchased during 1939. Other agencies now own as many prints of Department films as are circulated by the Department itself.

Thirty-seven new motion pictures were completed and released during the year. These dealt with a variety of subjects ranging from grasshopper control to recreation in the national forests. By the end of the year, 8,000 prints of Department films were available for distribution under the loan service.

The Motion Picture Section of the Extension Service also furnished advice to educational institutions, commercial and other organizations, field workers, and cooperators on the production and use of motion pictures and selection and use of motion-picture equipment.

Studies improve extension methods.

A broad program of research aimed at increasing the effectiveness of the work is important in any educational enterprise that involves an annual expenditure of nearly 33 million dollars and influences more than 5,400,000 rural families each year. Such a research program is carried on by the Extension Service through cooperation between the Surveys and Reports Section of the Federal office and the various State extension services. Progress in developing measurements of the educational growth of boys and girls resulting from participation in 4–H Club work was a significant development in 1939. New tests being developed will make possible a wide range of studies that will enable workers to improve the program planning, organization, methods, and evaluation of extension work with rural young people.

Careful analyses of annual statistical and narrative reports of county and State workers were made available to specialists and supervisors to guide them in increasing the effectiveness of the work.

Extension staff members continued to show keen interest in professional improvement by taking advantage of opportunities to fit themselves more adequately for their jobs. Seven hundred and seventy workers attended the 3-weeks to 8-weeks in-service training courses given at 13 State colleges during the summer of 1939. Courses in extension methods and extension organization and program development—based largely upon research findings in these fields—were especially popular.

A Better Way of Life

Farm families are the foundation of agriculture, and better living for farm families is the primary goal of agricultural improvement.

The home demonstration staff of the Extension Service aided more than 2 million rural families to make progress toward better rural living in 1939. These 2 million families built or repaired their houses, attained better physical health and mental outlook, were better clothed without additional cost, or carried on needed tasks with greater ease and satisfaction. They made plans for better use of the available resources of the farm to meet the family's needs. They added to their cash income through such means as home industries and farm women's markets, and by more efficient use of available cash when making needed purchases for family living.

They added to the comfort and attractiveness of their homes and gained more time in which to rest and find wholesome, inexpensive enjoyment within the home and community. They enjoyed better cooperation within the family group and with others, and improved conditions in their communities.

Sincere interest in such improvement of rural living was evident throughout the Nation—evident in widespread interest in beautification of home grounds; evident in the untiring efforts and hard labor that mothers put into the repair, reconditioning, and refinishing of furniture; evident in their willingness to shampoo rugs and to make curtains, slip covers, and draperies, all in the interest of adding beauty and cheer to the home; evident in the willingness and zest of both fathers and mothers in attending recreation training schools to learn to make home-made toys and games and to play games with their own and their neighbors' children; evident in the interest of parents in the study of child development and family relationships. These efforts are indicative of the unselfish energy of men and women in trying to make their homes havens for their families' enjoyment and worthy assets to their communities.

Home demonstration clubs, organized to bring extension teaching to interested rural women, are the foundation of the program. From the nucleus of these organized groups, information concerning improved homemaking practices spreads to farm families everywhere, regardless of race, creed, color, or income. There were 47,812 such clubs in 1939, with 1,118,519 members, an increase of 800 clubs and 14,000 members above the 1938 totals.

Over a million members in demonstration clubs.

Most of these clubs met at monthly intervals under the guidance of the county home demonstration agent. Together the homemakers studied the current economic and social situation, the resulting home

problems, and ways of solving them. Home demonstration agents stimulated them to want to know facts, to make their own decisions based upon accurate information, and to plan practical goals of improvement—for self-help is a basic principle of home demonstration work.

A democratic process of planning, with local rural women taking part, continued to be the foundation for the home demonstration program in 1939, as it has been for 15 years. Through county home demonstration councils and similar local committees, these women analyzed the major problems confronting their homes and communities and indicated the program to be undertaken for solving them.

Assisting home demonstration agents to inspire the vast membership of these clubs were 236,535 volunteer leaders, rural women who served without pay in spreading valuable information to the homemakers of their communities. Without their efforts, the impressive 1939 accomplishments of home demonstration work would not have been possible, for these volunteer leaders are a vital link in the chain which carries new practices from the State colleges and the Department of Agriculture to farm homes everywhere. There were 20,500 more such leaders in 1939 than in 1938, giving evidence that the home demonstration program is meeting fundamental needs of rural families and is inspiring farm people to help themselves and their neighbors.

Two hundred thousand are volunteer leaders.

Reaching a larger number of rural people is a continuous objective of the home demonstration staff in all States. During 1939, several States made detailed analyses of the situation to determine whether their programs were reaching all income groups and all age levels of farm women. Such an investigation in California revealed that since 1930, home demonstration work has reached 62 percent of all farm homes in counties having home demonstration agents. Georgia studies showed that families of tenant farmers made up 47 percent of the membership of clubs organized by home demonstration agents. An Ohio survey indicated that the proportion of home demonstration club members below 45 years of age increased from 35 percent in 1935 to 52 percent in 1939.

Reach all classes of farm families.

A survey of home demonstration clubs in 20 Indiana counties showed that 15 percent of the women were under 30 years of age and only 29 percent were over 50 years of age. One-third of the families reported net incomes under $500, and only 20 percent reported $1,500 or over.

Good health is a step toward good living, and measures for improving the health of farm people were important in the 1939 home demonstration program. Accident prevention, care of the injured and the ill, home sanitation, nutrition requirements for good health, and disease prevention were taught in home demonstration clubs throughout the country. Cooperation between home demonstration agents and public health agencies made possible greater service to rural people in improving health. As a result of these teachings, more than 378,000 people were immunized against typhoid, diphtheria, or smallpox; 81,282 families screened their homes; 124,302 families used recommended methods of

Improve farm family health.

control of flies and mosquitoes; and 59,935 families installed sanitary toilets. Child-feeding practices were improved, and better balanced meals were served in many homes.

Nearly 370,000 individuals reported enjoying improved health as a result of the extension program, but the most important results cannot be measured in figures. More significant than any of these definite practices for safeguarding health was the spreading of knowledge. Because they now know what to do and how to do it to protect the health of their families and to care for the ill and the injured, rural women in every part of the Nation are better equipped to safeguard human resources against the ever-present hazards of accidents and disease.

Health is mental as well as physical, and the mental health of the farm family was not neglected in the home demonstration program. Study of mental attitudes and social changes aided farm families to maintain good family relationships in spite of continued low income. Activities to provide variety and relaxation in the life of the farm family were important in maintaining morale. Family fun nights, family and community picnics, mothers' vacation camps, and tours to points of interest were features of the extension program in many States. Musical talents of farm people were developed through choruses. In Indiana, 1,500 women representing 70 counties participated in a music festival held during farm and home week.

Study of good books and development of local library facilities added interest and variety to life in many rural communities. In Muskingum County, Ohio, the home council, the home demonstration agent, and the Zanesville librarian cooperated to establish libraries in 12 communities during the year. Thirteen other Ohio counties reported specific attention to books and reading for the farm family. Book reviews were regular features of home demonstration club meetings in Kansas and many other States. Nearly 25,000 Nebraska women were enrolled in a Read for Facts and Sing for Fun project.

Oregon extension workers looked back over results of the 8-year period during which family and community recreation has played a distinct part in their home demonstration work and found that friendships had been formed, communities brought together, and attitudes toward life changed through this attention to the social life of farm families.

Tackling the widespread problems of poor nutrition and low farm income, home demonstration workers in 1939 placed special emphasis on home production of food to meet the family needs. Diet patterns worked out by the Bureau of Home Economics served as guides. More than 196,000 families followed extension recommendations for storage of the home food supply, and more than 600,000 families were assisted in canning or preserving fruits, vegetables, and meats.

Food planning widely adopted.

In North Carolina, one of the States emphasizing home food production, every farm family received an extension leaflet giving a garden calendar, food requirements for the farm family, feed requirements and livestock and crop-rotation schedules. More than 183,500 home gardens were reported. Dairy specialists took a part in the program by encouraging the use of milk in the diet and giving instructions on home preparation of dairy products. During 1938–39, there was an increase of more than 11,000 in the number of family cows in the

State. Meat schools and poultry meetings added emphasis on home food production.

A $4,726,544 food-preservation program was conducted by the home demonstration clubwomen in Alabama. Despite adverse weather conditions, farm women in the State canned 3,072,931 quarts of food, which was supplemented with dried fruits and vegetables, year-round gardens, home dairies, cured meats, and home poultry production.

In New Mexico, the foods and nutrition project was reorganized to establish a single program with the family food supply as its basis. The extension nutritionist, agronomist, economist, animal husbandman, poultryman, dairyman, and horticulturist assisted county extension agents in setting up family food supply demonstrations in six counties.

More vitamins were stored in New Hampshire farm pantries as the result of a Better Living for the Farm project, which included a successful drive for the planting of small fruits and the use of more tomatoes, both fresh and canned.

Planting to provide fruits, nuts, and berries for family needs was a feature of home demonstration work in 20 Georgia counties. More than 94,800 peach trees, 3,600 apple trees, and 1,300 pear trees were planted, in addition to 22,584 grapevines, 202,499 strawberry plants, and a large number of figs, pecans, plums, quince, scuppernongs, raspberries, and youngberries.

Emphasis on meeting food needs extended to Alaska where much interest was shown in the preservation of vegetables, fish, and wild game. In Hawaii, also, steady progress in promoting food production continued. The production of food for home consumption in Hawaii has more than kept pace with the increase in population during the past 10 years, and the Islands now are more nearly self-sufficient in food than when extension work was started there 10 years ago.

Increased numbers of frozen-food lockers were available to farm families in many parts of the country during 1939, and extension workers filled a need by teaching present and prospective locker patrons the place of frozen foods in the food conservation budget, how to select and prepare vegetables, fruits, poultry, and meats for locker storage, and how to plan for efficient use of locker space. In meetings with locker plant owners, extension specialists emphasized the necessity of maintaining storage temperatures sufficiently low and even to insure high-quality products.

Freezer lockers aid food storage.

In the South, freezer-locker units are being considered and tested in combination with the long-established refrigerated meat-curing houses which in 1939 cured an estimated total of 50 million pounds of farm-dressed pork. The coming of freezer-locker facilities is making it possible for southern families to enjoy fresh home-raised meat throughout the year and is thus stimulating greater interest in diversified farming, including livestock for the home meat supply.

Meal planning, with special attention to the needs of children and to the contribution of happy mealtimes to family life, continued to be a popular feature of the home demonstration program in 1939. Such projects as "extending the prime of life," "food after forty," and "preventing human erosion" showed the interest of middle-aged and elderly people

Meal planning always popular.

in feeding themselves for continued physical fitness. In many States, particular attention was given to work with low-income groups, whose health often is undermined by inadequate diets. The Massachusetts State extension nutritionist worked closely with the administrator of surplus commodities and with town welfare boards in helping relief families to make good use of available food supplies. In South Dakota, a series of meetings featured a demonstration of preparing a meal in which eight surplus commodities were used. Families served by the W. P. A. and the F. S. A. were invited to attend, together with county superintendents of schools, home economics teachers, 4–H Club leaders, and others.

Clothing ideas learned through their home demonstration clubs aided rural women to conserve the family cash income in 1939.

Clothing teachings conserve farm income.

Homemakers were encouraged to make inventories of clothing on hand to determine those garments which could be made over or which needed to be replaced. They were given assistance in construction of garments so that clothing made in the home would have a tailored look. Loan pattern services were especially helpful to mothers of young children. Better buying practices were taught.

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Clothing accessories, both home-made and purchased, were considered as means of making one dress suited to various occasions. Instruction was given on safe methods of dry cleaning and pressing at home so that the family clothing could be kept in good order at little expense. Home laundering of silk and wool garments also was taught. Savings to rural families as a result of clothing work through home demonstration clubs in 1939 were estimated to be more than 2 million dollars. The work had added value because of its aid in maintaining the morale of farm families.

A striking result of extension clothing instruction during the past decade is that farm women throughout the United States today present a well-dressed appearance and have the personal satisfaction and the poise that result from being appropriately even though inexpensively dressed. The self-confidence thus developed is at least partially responsible for the fact that rural women in large numbers are contributing to the discussion in public meetings without self-consciousness and are accepting positions of responsibility in organizations and in community activities.

Nearly 8,700 new farm homes were constructed according to plans furnished by extension workers in 1939, and more than 22,500 homes were remodeled according to extension suggestions. Definite progress toward better rural housing was accomplished.

Progress toward better housing.

Kitchens in more than 12,000 Texas rural homes were improved as the result of an extension project with kitchen sanitation and convenience as its keynote. Rural better homes week was observed by 526 home demonstration clubs in 57 Mississippi counties, and 9,163 families made improvements in their homes, farm buildings,

and grounds as a result. A low-cost home-improvement project, designed for the family which can spend but little each year, was conducted by the Maine Extension Service.

Such efforts to make the farm home a more comfortable and satisfying place to live have long been important features of extension work. Providing house plans, offering suggestions on remodeling old homes for greater convenience and comfort, demonstrating inexpensive pieces of homemade equipment for greater home convenience, offering advice on purchase of new furnishings and demonstrating methods of refinishing old furniture—all have been services offered through county agricultural and home demonstration agents.

The coming of electricity to approximately 379,000 farms was the most important development in rural housing during 1939, and the arrival of this labor-saving and comfort-bringing aid was reflected in requests for advice on the wiring of farm buildings and the purchase of electrical appliances that poured into county extension offices. To meet this new need, consumer education meetings by the hundred were held to help farm families plan their wiring and their placing of outlets, and to help them get their money's worth when they went to the store to buy the new electric refrigerator, electric iron, toaster, or radio. Suggestions were given for profitable use of electric power for feed grinding, wood sawing, ensilage cutting, operating milking machines, and similar farm tasks. Particular attention was given to better lighting and the conservation of eyesight.

Electricity brings many new questions.

Extension exhibits and talks were features of the program of a traveling show of electrical farm equipment sponsored by the Rural Electrification Administration, which was attended by 175,000 farm people in 8 States. And meetings of interested farm people arranged by county extension agents laid the ground work for organization of R. E. A. cooperatives in many communities.

To make the home attractive is to make the family proud of its dwelling and thus strengthen the family bond, as all parents know. Extension work in 1939 contributed to making rural homes more attractive both inside and out.

Add beauty at low cost.

Farm women learned from home demonstration agents and volunteer local leaders methods of refinishing and reupholstering furniture and refinishing floors and walls. They studied redyeing of old fabrics and selection of inexpensive materials of good color and design to make attractive draperies, curtains, slip covers, and other accessories. They received information on furniture arrangement, picture placing, window treatment, and planning of storage space to avoid cluttered rooms. In the cotton-growing States, they learned to make mattresses worth $25 from $6 worth of home-grown cotton.

An indication of the intense interest in this work is the fact that more than 185,800 families followed recommendations in improving methods of repairing, remodeling, or refinishing furniture in 1939. The total cash saving resulting from the home-furnishing program is estimated to be $1,784,860. There were far greater dividends in lasting satisfaction and enjoyment, for the most important result of home improvement is the more enjoyable home life beginning with such simple changes as better placing of light, new curtains, or even rehanging of pictures.

Farm home grounds were beautified by landscaping and cleaning up. A total of 148,400 families followed extension suggestions in planting trees and shrubs. Many used native materials brought from nearby woods. Painting of buildings, mending of fences, and laying out of attractive walks and drives were other noticeable improvements at more than 100,000 homes.

In Arkansas, 266 communities including 11,400 homes were enrolled in an extension-sponsored community landscape demonstration contest. With "making the best of what one has" as its slogan, the contest emphasized general cleaning up of premises around each home, removal of unsightly piles of rubbish and refuse, straightening fences, painting or staining buildings and garden or yard fences and posts, and beautification of premises by planting shrubs and flowers, sodding lawns, and building walks.

Rural women in many States acquired a better understanding of such business papers as mortgages, notes, checks, wills, and deeds in 1939 through their home demonstration clubs. Farm-credit facilities also were studied, as home demonstration agents aided farm women to achieve clearer knowledge of the "business side" of farming.

Farm families study income management.

Account keeping as a step toward better management of the family income was adopted in 44,365 homes. The practice of budgeting expenditures in relation to income gained favor, and the establishment of farm-family financial councils—with every menber of the family taking part in budget planning—showed marked progress. Information concerning the economic outlook for farm-family living during the coming year was studied in home demonstration clubs throughout the Nation. Such discussions focused attention on the need for home production of food and fuel so as to release cash income for the purchase of manufactured goods. They also brought home to rural people the relation between city and rural levels of living and the interdependence of city and rural well-being.

Measures for supplementing the cash income of the family continued to be of interest to women and girls, many of whom sold homemade articles through cooperative markets sponsored by their home demonstration clubs. Nearly 41,500 families were assisted by extension agents in developing such home industries as a means of supplementing their incomes.

Gross sales under the miscellaneous marketing project of the Georgia Extension Service totaled $543,913. The combined total of all products sold from marketing projects carried on by Arkansas home demonstration women was $1,198,399. Alabama and North and South Carolina likewise reported important results from this work.

Making farm communities more satisfactory places in which to live is a continuous extension goal. Promotion of strong local organizations is a method used for attaining that goal. Through these organizations, the activities of the entire community are united in drives for such improvements as community hospitals, rural electric lines, serving of hot school lunches, organization of county choruses and other art and recreational projects, community forests, road improvement, and construction of community meeting centers. In 25 States, members of the State extension staff

Build better communities.

were specially assigned to definite duties in connection with rural community development in 1939, and in all States community improvement was a phase of the extension program.

Because recognition of community problems is necessary before general interest can be aroused in solving those problems, Massachusetts extension workers emphasized a "know your community" survey in connection with land use planning meetings and other local meetings. Louisiana in 1939 made a survey of 60 community organizations established 15 years earlier and found that 40 of them still were active, with records of outstanding accomplishment in improving local economic, civic, health, and recreational conditions.

Community-center buildings were constructed or maintained during the year in Georgia, Arkansas, and Illinois. Community councils were promoted in Massachusetts, New Hampshire, New York, North Dakota, and Missouri. Community beautification, safety, health, drama, and music were encouraged in many States.

Many of the Nation's nearly 48,000 home demonstration clubs devoted a part of their energy to promoting specific community betterment projects. Types of improvement accomplished ranged from landscaping school grounds and serving hot school lunches to sponsoring monthly community "family nights" and purchasing sickroom equipment for community use where hospital service was not readily available.

Among the year's new and striking community projects were the demonstration forests on idle farm acres established by Arkansas home demonstration club members in nine counties. The land was leased to the county home demonstration councils for a sufficient period for the seedlings to grow sawlog trees or fence posts.

A State-wide tree-planting project sponsored by Connecticut home demonstration club members resulted in the planting of some 20,000 trees and shrubs in private grounds and around churches, schools, greens, and public buildings in an effort to restore some of the beauty destroyed by the hurricane of 1938.

In Hennepin County, Minn., one home demonstration club organized and conducted a nonsectarian Sunday school, and another worked with other community groups in a campaign for better motion pictures for the children's Saturday matinee.

In Kittitas County, Wash., home demonstration clubs rendered vital service in crystallizing community effort that resulted in building a new county hospital.

Human relationships new extension field.

A growing demand from rural people for help in child-development and family-relationship problems was evident in 1939. Recognizing that many of the major problems of living are due to inability to get along with other people and that this results from lack of knowledge of human nature and its needs and capacities, farm people turned to the Extension Service for help. Parents of 267,944 children participated in group meetings held by home demonstration agents to help adults better to understand themselves and their children. Parents learned what to expect of children and of themselves at different age levels, how to train emotions as well as minds and muscles, and to discuss family-life problems objectively.

Farm-family councils were encouraged to develop the family as a social unit, with every member interested in the welfare of all the

others and with every member sharing in the responsibility of planning for the family future.

During the past decade there has been a continuously mounting interest in this field of work. The increasing complexity of farm-family experiences in recent years has created many problems of relationships within the family and the community. There is need for understanding the effects of changing agricultural and social programs, and for planning accordingly. In addition, farm men and women have received guidance in the best use of community programs leading to individual development.

Tomorrow's Men and Women

The training of youth molds the attitudes and ideals of maturity. That fact lends tremendous national significance to the American system of 4–H Clubs—a system of rural-youth education for living that is unduplicated elsewhere in the world. Supplementing the classroom training of schools with experience in agriculture and homemaking, and with social training through group activities, these clubs of farm young people have acquired a place of unique importance in modern United States.

As the twig is bent.

More than 8 million rural young people have been club members during the last 25 years. Boys and girls from all types of families have been included—sharecroppers, tenants, and farm owners alike.

The former club members now assuming tasks of local and State leadership in agriculture, business, and government demonstrate the power of 4–H Club training in building character and ability. The increasing percentage of the Nation's rural youth enrolling in these clubs each year demonstrates the popularity of this movement, with its four-fold program for development of head, heart, hands, and health.

Membership in 4–H Clubs in 1939 totaled 1,381,595, an increase of 7.4 percent above the 1938 total and the largest membership in the 25-year history of this rural-youth organization. This was a continuation of a trend which has been evident for several years. Enrollment has increased more than one-third since 1935.

4–H membership reaches new high.

More than 75 percent of these rural young people completed their project work for the year, which was a new high in accomplishment reflecting the high quality of supervision given club work by 147,000 volunteer local leaders and by extension staff members. The quality of project work throughout the country was higher than in any previous year.

The 4–H Club projects undertaken in 1939 represented a wide variety of fields in improved farming and homemaking in keeping with the needs and interests of rural young people.

An increased interest was noted in all phases of the 4–H food-club work which, as in many previous years, ranked first in the number of members enrolled. The dietary needs of the family and the use of home-grown foods were widely emphasized. In all, 8,900,000 jars of fruits, vegetables, and meats were canned. In addition, more than 1,500,000 jars of

Food projects most popular.

jelly were made and nearly 3,000,000 pounds of fruits and vegetables were dried by those members enrolled in food preservation.

The 346,466 young people enrolled in meal preparation reported that a large number of meals had been carefully prepared for various periods in keeping with the nutritional needs of the entire family, in addition to the work in baking and the preparation of wholesome school lunches. Thousands of girls reported that they did the canning for their entire families, thus demonstrating that they have been able through club work to share home responsibilities.

In many States, all club members checked their food and health habits and gave special consideration to the care of their teeth and to good posture from the viewpoint of food selection. Nearly 18,500 club members had health examinations, either as a part of their club activities or in connection with health contests. Dental clinics were held in several States. The 4–H Club garden and orchard work also played a prominent part in the general nutrition program throughout the country.

As usual, clothing work proved highly popular. Increasing emphasis was placed on the use of a practical clothing budget for the rural girl in her efforts to dress well at small cost. More than 81,000 club girls kept clothing accounts throughout the year, and 34,178 budgeted their clothing expenditures. Other phases of clothing work demonstrated by the 350,000 club members enrolled included garment construction, the selection and purchase of materials and of ready-made garments, the construction of children's garments, and the care, repair, and remaking of garments. Shopping tours to develop good "buymanship" practices were encouraged. Color clinics to help girls to make harmonious color selections were popular in several states. Considerable interest was noted in the making of attractive garments and other articles of clothing from feed and sugar bags as a thrift measure. It is estimated that thrift practices demonstrated in the clothing program saved more than $939,000 during the year.

Promote practical clothing budget.

Thrift measures were also practiced by the 4–H Club members engaged in refurnishing their own rooms and sharing in the general responsibility of making the whole farm home more comfortable and enjoyable, thus making for family solidarity.

Demonstrating better seed selection and crop cultivation was a field in which club boys took an important part in 1939. In a number of States, much interest was shown in the results attained by members using hybrid seed corn. Cotton, potatoes, wheat, oats, barley, peas, soybeans, clovers, pastures, and sugar beets were among the other crops grown by club members.

Considerable gains were noted in the livestock undertakings of club members due to increased extension personnel, better economic conditions in the livestock industry, and impetus given livestock club work by breeders, bankers, and businessmen who have supported such projects by lending money, offering prizes for quality work, and other means. The chief demonstrations undertaken by club members continued to be those concerned with the introduction of better stock, feeding, management,

Livestock projects show large gains.

and marketing. In Nebraska, 8 junior bull rings included 42 bulls which were used in 126 dairy herds in which were heifers of breeding age owned by club members.

Demonstrations dealing with soil improvement have been increasing in recent years. The laying out of terrace lines and the construction of terraces, testing soils for lime and phosphate requirements, and the growing of legume crops for soil improvement are becoming popular.

Variety of other activities under way.

In New York, 1,471 club members enrolled in forestry projects. First-year enrollees each received 1,000 trees through the cooperation of the State conservation department and used these trees to carry out reforestation on approximately 1,050 acres. In the last 14 years, nearly 14 million trees have been planted under this plan. The Washington County 4–H Club Forest alone now contains more than 40,000 trees.

Beekeeping was undertaken in several States. Production of honey by Pennsylvania club members for the past few years has averaged 84 pounds per colony of bees a year, which is 60 pounds greater than the State average.

Farm-management methods were studied by numerous club members, with especial interest being shown in such topics as how to do business at a bank; how to record legal papers; how to take a farm inventory and make a credit statement; and how to get and use credit. Home management likewise was studied, including the keeping of home accounts. Many girls, because of what they had learned in their 4–H Club work, were able to take care of their homes while their mothers went to town, to a farm women's camp, or to farmers' week at the State college.

Club work with Negro farm youth has grown gradually since its beginning about 20 years ago. Enrollment in 1939 was 178,544, a gain of 15,109 members over 1938.

An important objective of 4–H Club work is the development among young people of constructive group action and group control, which are in keeping with democratic government. Among group activities that aid these farm young people in learning how to work with others so that all may have maximum benefit are the club demonstration teams and judging teams, work in music appreciation and dramatics, tours and hikes, camps, club ceremonies, exhibits, and achievement days. During 1939, county extension agents trained 52,828 4–H Club demonstration teams that influenced the spread of improved farming and homemaking practices in their own and nearby communities.

Training for democracy.

During 1939 it was the common thing for clubs, in addition to their farm and homemaking project activities, to plant shrubbery and flowers about local schoolyards, town halls, and roadsides; to produce and sell disease-free seed at reasonable prices; to make children's clothing for needy families; to provide hot lunches for local schools; to help to promote county-wide soil and livestock campaigns; to establish community and county fairs; to maintain and improve 4–H Club camps; and to develop dramatics and other recreational activities for community programs.

The needs and possibilities of young people were given consideration in the planning of the general extension program for 1939 to a greater degree in most States than ever before. The economic aspects of the club programs were given consideration in the outlook conferences held at the beginning of the year, and in special literature prepared for the use of club members at regular meetings and in discussion groups at community meetings. Ample opportunity was provided for the participation of rural young people in both planning and carrying out the general community extension programs, and in several of the other national programs operating on a county and community basis.

Improve program planning methods.

Club programs for the year included activities for enrichment of everyday living, such as work in music, art appreciation, study of good books, and study of the great outdoors.

In New Hampshire an effort was made to spread the influence of club work over the entire community by asking other groups and individuals to participate in certain 4–H Club projects for the good of the community or State, without losing their identity and without joining 4–H Clubs. Nine hundred boys were organized into groups of 4–H Forest Rangers to help guard against the great hazard of forest fires in the hurricane-blown areas. They were taught fire-fighting methods and were assigned areas to protect. The plan worked so well that it will be extended in 1940 to other projects.

Rural young people above 4–H Club age who are seeking a livelihood that will enable them to establish homes of their own found assistance in many States through the organization of special clubs often known as senior or alumni 4–H Clubs with programs designed to meet their special interests. By the end of 1939, there were 2,073 of these older-youth clubs with 71,701 members.

Organize clubs for older youth.

Vocational guidance and agricultural and homemaking information that would aid in equipping them to start homemaking and farming for themselves were of special interest to these older youth. Recreational activities and those pertaining to social development also were included in the programs. Several State extension services sponsored State-wide conferences for delegates from these groups, which afforded opportunities for exchange of experiences, as well as providing contact with important leaders in many vocational fields.

Progress Through Leadership

Most outstanding among the accomplishments of extension work in its quarter century of service to rural United States has been the development of volunteer rural leaders—the training of interested farm people to inspire and educate others in scientific agricultural and home-making methods. More than half a million men and women volunteer as local leaders every year. Through these unpaid leaders who believe, practice, and defend extension recommendations, the rank and file of farm people have come to accept and practice new methods of farming and homemaking. Methods of husbandry that were unknown even to county agricultural agents when extension

was new are today understood and practiced by farmers throughout the Nation. And the county agent and the home demonstration agent, once regarded as purveyors of unessential theories, are today welcome and trusted counselors to farmers everywhere.

This legion of volunteer leaders, created by a quarter century of cooperative effort toward more satisfying rural living, has also taken a leading role in putting into operation the Government action programs of recent years directed at pressing economic and social problems.

As extension work marches into its second quarter century, the local leaders who so freely donate their time and effort to the cause of American agricultural progress form the vanguard of the procession.

Facts in Figures

TABLE 1.—*General summary of extension activities and influence, 1939*

Item	Number	Counties reporting
County associations fostering extension work	6,833	2,618
Members in such associations	872,089	2,552
Communities in counties	79,750	2,967
Communities with extension program	64,555	2,773
Voluntary local leaders:		
Men leaders in adult work	237,963	2,615
Women leaders in adult work	236,535	2,576
Men leaders in 4–H Club work	39,076	2,641
Women leaders in 4–H Club work	65,016	2,708
Older club boy leaders in 4–H Club work	17,760	1,747
Older club girl leaders in 4–H Club work	25,498	1,794
Clubs or other groups organized to carry on adult home demonstration work	47,812	2,404
Members in such clubs or groups	1,118,519	2,389
Organized 4–H Clubs	78,599	2,952
Members in 4–H Clubs:		
Enrolled	1,381,595	2,916
Completed	1,039,244	2,897
4–H Club projects:		
Started	2,757,543	2,916
Completed	1,977,088	2,897
Groups organized for extension work with rural young people above club age	2,073	1,025
Membership	71,701	949
Total number all meetings held by county extension agents	1,319,239	2,915
Attendance	46,679,905	2,915
Adult meetings held by local leaders not participated in by agents	308,645	2,495
Attendance	5,678,707	2,490
4–H Club meetings held by local leaders not participated in by agents	422,113	2,472
Attendance	5,648,346	2,470
Farms in counties with extension agents [1]	6,816,768	2,983
Farms on which changes in practices have definitely resulted from agricultural extension program	3,594,360	2,820
Homes in which changes in practices have definitely resulted from home demonstration program:		
Farm homes	1,346,695	2,386
Other homes	603,148	2,251
Homes with 4–H Club members enrolled:		
Farm homes	820,425	2,846
Other homes	192,281	2,516
Families influenced by some phase of the extension program:		
Farm families	4,594,859	2,924
Other families	886,938	2,747

[1] Census, 1935.

TABLE 2.—*Number of counties with county extension agents, July 1, 1915, 1925, 1935, and 1939, and total number of extension workers, July 1, 1939*

State	Counties in State	Counties with agents on July 1—								Total extension workers, July 1, 1939
		1915		1925		1935		1939		
		Men	Women	Men	Women	Men	Women	Men	Women	
Alabama	67	67	19	59	37	67	44	67	66	350
Arizona	14	3		12	9	11	6	12	9	38
Arkansas	75	52	20	50	39	75	72	75	75	241
California	58	11		43	22	43	25	42	30	187
Colorado	63	13		20	2	45	5	51	16	102
Connecticut	8	6		8	7	8	8	8	8	69
Delaware	3	3		3		3	3	3	3	22
Florida	67	36	27	36	30	44	29	57	36	145
Georgia	159	81	48	121	61	155	80	159	93	368
Idaho	44	3		16	27	31	37	31	30	61
Illinois	102	18		95	21	97	39	102	65	236
Indiana	92	31		79	1	91	12	91	45	228
Iowa	99	11		99	15	99	35	99	77	290
Kansas	105	39		63	15	100	27	103	48	263
Kentucky	120	39	19	72	24	114	29	120	50	279
Louisiana	64	43	13	48	24	62	52	64	62	218
Maine	16	3		16	15	16	15	16	16	61
Maryland	23	13	6	23	19	23	23	23	23	101
Massachusetts	14	10		11	11	11	10	11	10	100
Michigan	83	17		57	5	73	5	81	37	194
Minnesota	87	23		58	8	86	11	87	23	245
Mississippi	82	49	33	54	44	79	69	82	73	320
Missouri	114	15		50	9	114	14	114	65	257
Montana	56	8		23	6	40	8	46	12	81
Nebraska	93	8		43	2	93	14	93	24	181
Nevada	17			8	9	14	6	14	5	23
New Hampshire	10	5		10	8	10	10	10	10	63
New Jersey	21	7		18	11	19	15	20	17	93
New Mexico	31	8		21	5	24	10	31	17	79
New York	62	29		55	38	51	37	55	40	328
North Carolina	100	64	34	74	49	97	53	100	85	382
North Dakota	53	15		33	1	53	4	50	12	107
Ohio	88	10		85	15	84	22	87	50	235
Oklahoma	77	56	24	65	44	77	68	77	77	245
Oregon	36	12		28	3	34	6	36	11	98
Pennsylvania	67	14		63	28	65	63	66	66	226
Rhode Island	5			5	2	5	5	5	5	27
South Carolina	46	43	24	40	38	46	46	46	46	210
South Dakota	69	5		34	32	69	27	61	38	120
Tennessee	95	38	24	50	26	95	42	95	65	312
Texas	254	99	27	155	88	235	151	252	182	639
Utah	29	10		18	11	21	8	25	8	61
Vermont	14	9		12	7	14	11	14	14	57
Virginia	100	55	22	65	35	93	42	99	58	299
Washington	39	10		26	5	38	8	39	20	113
West Virginia	55	27	10	36	15	44	27	48	35	151
Wisconsin	71	12		48	1	65	7	67	27	202
Wyoming	23	6		16	5	20	7	20	7	42
Alaska										6
Hawaii	5					4	4	4	4	42
Puerto Rico								32	16	78
Total	3,075	1,136	350	2,124	929	2,857	1,351	2,990	1,911	8,875

TABLE 3.—*Expenditures of funds from all sources for cooperative agricultural extension work in States, Alaska, Hawaii, and Puerto Rico for the year ended June 30, 1939, by sources of funds, and totals for 1934–38*

State or Territory	Grand total	Total Federal funds	Total within the States	Funds from Federal sources				Funds from within States		
				Clarke-McNary	Smith-Lever, supplementary, and Bankhead-Jones	Capper-Ketcham	Additional cooperative	State and college	County	Farmers' organizations, etc.
Alabama	$933,048.30	$666,796.87	$266,251.43	$1,620.00	$627,576.26	$37,600.61		$181,939.10	$84,312.33	
Arizona	178,447.59	117,007.52	61,440.07		86,263.53	22,643.99	$8,100.00	28,549.91	32,190.46	$699.70
Arkansas	805,174.52	552,972.73	252,201.79		519,354.71	33,618.02		201,317.25	50,884.54	
California	931,010.85	395,421.95	535,588.90	1,620.00	359,767.04	34,034.91		322,162.20	213,426.70	
Colorado	354,722.77	212,239.38	142,483.39	900.00	165,665.23	24,774.15	20,900.00	74,465.87	68,017.52	
Connecticut	302,480.98	130,658.55	171,822.43	1,020.00	97,949.33	24,317.71	7,371.51	113,039.30	45,500.00	13,283.13
Delaware	93,071.05	74,832.65	18,238.40		53,766.29	21,066.36		17,489.53	748.87	
Florida	432,574.58	219,435.74	213,138.84		180,480.00	26,555.74	12,400.00	104,139.07	108,999.77	
Georgia	1,051,106.82	702,415.79	348,691.03	1,327.50	662,460.14	38,628.15		84,831.94	263,859.09	
Idaho	268,751.95	155,850.01	112,901.94	1,620.00	118,010.19	22,919.82	13,300.00	53,073.69	59,828.25	
Illinois	1,169,931.83	563,771.78	606,160.05	1,620.00	523,691.00	38,460.78		144,043.68	50,769.84	411,346.53
Indiana	937,745.23	443,566.47	494,178.76	1,620.00	408,596.75	33,349.72		234,053.57	219,219.21	40,905.98
Iowa	1,200,276.02	510,108.28	690,167.74	1,620.00	474,684.79	33,803.49		217,110.26	325,331.16	147,726.32
Kansas	969,657.37	390,405.49	579,251.88	1,020.00	357,632.77	30,652.72	1,100.00	108,226.39	337,929.22	133,096.27
Kentucky	861,726.70	603,553.18	258,173.52		566,752.21	36,800.97		120,000.00	137,835.51	338.01
Louisiana	728,643.10	441,148.96	287,494.14	1,620.00	407,794.50	31,734.46		193,799.14	93,695.00	
Maine	242,976.32	156,068.80	86,907.52		125,714.73	24,404.07	5,950.00	50,992.42	28,946.41	6,968.69
Maryland	469,593.27	196,959.36	272,633.91	1,620.00	162,562.75	26,076.61	6,700.00	189,865.83	67,211.52	15,556.56
Massachusetts	485,470.65	138,855.65	346,615.00	1,620.00	105,265.80	23,869.85	8,100.00	116,381.01	230,233.99	
Michigan	814,646.54	450,609.16	364,037.38	1,620.00	414,735.90	34,253.26		220,653.38	143,384.00	
Minnesota	784,924.48	465,480.85	319,443.63	1,620.00	431,772.19	32,088.66		138,726.16	166,475.82	14,241.65
Mississippi	1,014,464.00	652,760.29	361,703.71	1,620.00	615,677.36	35,462.93		104,787.10	250,264.11	6,652.50
Missouri	889,164.83	579,039.79	310,125.04		542,658.16	36,381.63		112,992.40	148,689.34	48,443.30
Montana	357,786.01	174,599.66	183,186.35	799.92	126,750.09	23,299.65	23,750.00	52,807.42	130,378.93	
Nebraska	626,673.99	345,381.17	281,292.82	1,620.00	296,208.06	28,253.11	19,300.00	137,613.48	114,958.73	28,720.61
Nevada	133,399.54	73,181.21	60,218.33		40,107.50	20,523.71	12,550.00	30,319.79	29,898.54	
New Hampshire	233,963.26	94,822.53	139,140.73	1,620.00	66,623.81	21,778.72	4,800.00	78,515.45	60,625.28	
New Jersey	444,120.02	172,752.86	271,367.16	1,620.00	131,535.82	26,497.04	13,100.00	98,432.94	170,129.73	2,804.49
New Mexico	295,498.21	142,486.20	153,012.01		108,357.34	22,928.86	11,200.00	90,274.22	62,717.79	20.00
New York	1,778,549.12	478,682.91	1,299,866.21	1,620.00	437,945.40	39,117.51		541,455.66	740,014.28	18,396.27
North Carolina	1,250,864.06	794,317.00	456,547.06	1,620.00	750,853.92	41,843.08		110,000.00	346,547.06	
North Dakota	380,655.53	249,212.02	131,443.51	1,260.00	207,450.09	25,251.93	15,250.00	25,406.82	106,036.69	
Ohio	1,031,428.37	581,560.65	449,867.72	1,440.00	540,323.63	39,797.02		217,832.62	232,035.10	
Oklahoma	922,945.81	531,272.54	391,673.27		496,703.64	34,568.90		280,949.43	110,723.84	
Oregon	485,533.01	186,961.05	298,571.96		141,966.89	24,294.16	20,700.00	175,991.61	110,628.13	11,952.22
Pennsylvania	1,039,121.94	619,030.48	420,091.46	1,260.00	569,103.51	48,666.97		280,091.45	140,000.01	

TABLE 3.—*Expenditures of funds from all sources for cooperative agricultural extension work in States, Alaska, Hawaii, and Puerto Rico for the year ended June 30, 1939, by sources of funds, and totals for 1934–38*—Continued

State or Territory	Grand total	Total Federal funds	Total within the States	Funds from Federal sources				Funds from within States		
				Clarke-McNary	Smith-Lever, supplementary, and Bankhead-Jones	Capper-Ketcham	Additional cooperative	State and college	County	Farmers' organizations, etc.
Rhode Island	$80,085.68	$60,202.08	$19,883.60		$39,720.25	$20,481.83		$4,786.00	$9,976.20	$5,121.40
South Carolina	667,929.22	476,878.98	191,050.24		444,222.61	32,656.37		162,398.88	28,651.36	
South Dakota	347,853.35	259,912.11	87,941.24		204,661.98	25,200.13	$30,050.00	40,235.81	47,705.43	
Tennessee	875,468.37	609,056.19	266,412.18	$1,620.00	571,519.39	35,916.80		114,922.30	151,489.88	
Texas	1,959,086.80	1,140,316.81	818,769.99	1,620.00	1,086,906.41	51,790.40		275,758.31	531,966.86	11,044.82
Utah	203,090.37	122,117.50	80,972.87	1,080.00	88,051.93	22,235.57	10,750.00	43,017.62	37,955.25	
Vermont	214,134.28	114,369.46	99,764.82	1,620.00	87,070.72	22,228.74	3,450.00	50,000.00	40,443.61	9,321.21
Virginia	877,232.25	514,637.26	362,594.99	1,620.00	477,875.04	35,142.22		216,571.99	140,748.00	5,275.00
Washington	350,199.37	218,624.73	131,574.64		186,442.68	26,282.05	5,900.00	32,519.75	99,054.89	
West Virginia	486,815.62	313,432.53	173,383.09	1,620.00	280,359.02	31,453.51		139,120.46	32,079.64	2,182.99
Wisconsin	780,797.58	468,525.12	312,272.46	1,620.00	434,087.02	32,818.10		100,556.29	204,265.22	7,450.95
Wyoming	199,104.94	109,877.22	89,227.72	1,260.00	66,928.54	21,438.68	20,250.00	51,751.44	37,476.28	
Alaska	27,507.75	21,418.00	6,089.75		13,918.00	7,500.00		6,089.75		
Hawaii	146,157.11	122,532.86	23,624.25		100,577.65	21,955.21		23,624.25		
Puerto Rico	286,643.56	139,365.33	147,278.23	1,620.00	137,745.33			147,278.23		
Total, 1939	32,402,254.87	17,955,485.71	14,446,769.16	50,247.42	16,142,847.90	1,487,418.88	274,971.51	6,660,961.17	6,844,259.39	941,548.60
1938	31,592,254.41	17,443,132.48	14,149,121.93	50,104.71	15,409,218.88	1,484,920.08	498,888.81	6,526,987.68	6,695,016.07	927,118.18
1937	[1] 30,033,606.59	17,030,093.32	13,003,513.27	49,701.50	14,660,842.68	1,479,691.65	742,168.40	5,870,476.76	6,330,977.27	802,059.24
1936	[2] 28,299,905.64	16,190,624.41	12,109,281.23	48,323.51	13,502,153.16	1,479,971.78	980,467.94	5,220,032.99	5,887,700.67	1,001,547.57
1935	[3] 20,440,902.01	8,945,153.85	11,495,748.16	43,981.94	6,196,581.60	1,472,568.37	980,834.82	5,089,445.11	5,457,263.66	949,039.39
1934	[4] 19,844,167.34	9,216,781.45	10,627,385.89	44,754.27	5,994,193.65	1,446,597.52	974,127.39	4,778,604.71	5,020,594.52	828,186.66

[1] Includes $97,689.09 from farmers' cooperative demonstrations funds.
[2] Includes $179,708.02 from farmers' cooperative demonstrations funds.
[3] Includes $251,187.12 from farmers' cooperative demonstrations funds.
[4] Includes $725,094.48 from farmers' cooperative demonstrations funds and $32,104.14 from other U. S. Department of Agriculture funds.

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U. S. GOVERNMENT PRINTING OFFICE: 1940

The 7th Annual Report of the Farm Credit Administration 1939



Seventh Annual Report
of the
Farm Credit Administration
1939

Letter from

The Secretary of Agriculture

Transmitting the Seventh Annual Report

of the Farm Credit Administration

covering its operations for the

year 1939

MARCH 4, 1940.—Referred to the Committee on Agriculture
and ordered to be printed, with illustrations

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Farm Credit Administration

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Deputy Governor.

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Letters of Transmittal

FARM CREDIT ADMINISTRATION,
February 21, 1940.

SIR: In accordance with the provisions of paragraph (3) of section 4 of the Agricultural Marketing Act, as amended, section 3 of the Federal Farm Loan Act, as amended, and the Executive order of March 27, 1933, creating the Farm Credit Administration, I have the honor to submit herewith the seventh annual report, covering operations of the Farm Credit Administration for the year 1939.

Respectfully,

A. G. BLACK, *Acting Governor.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES

UNITED STATES DEPARTMENT OF AGRICULTURE,
March 1, 1940.

SIR: I am transmitting herewith the seventh annual report of the Farm Credit Administration covering the operations of the year 1939.

Very truly yours,

HENRY A. WALLACE, *Secretary.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES

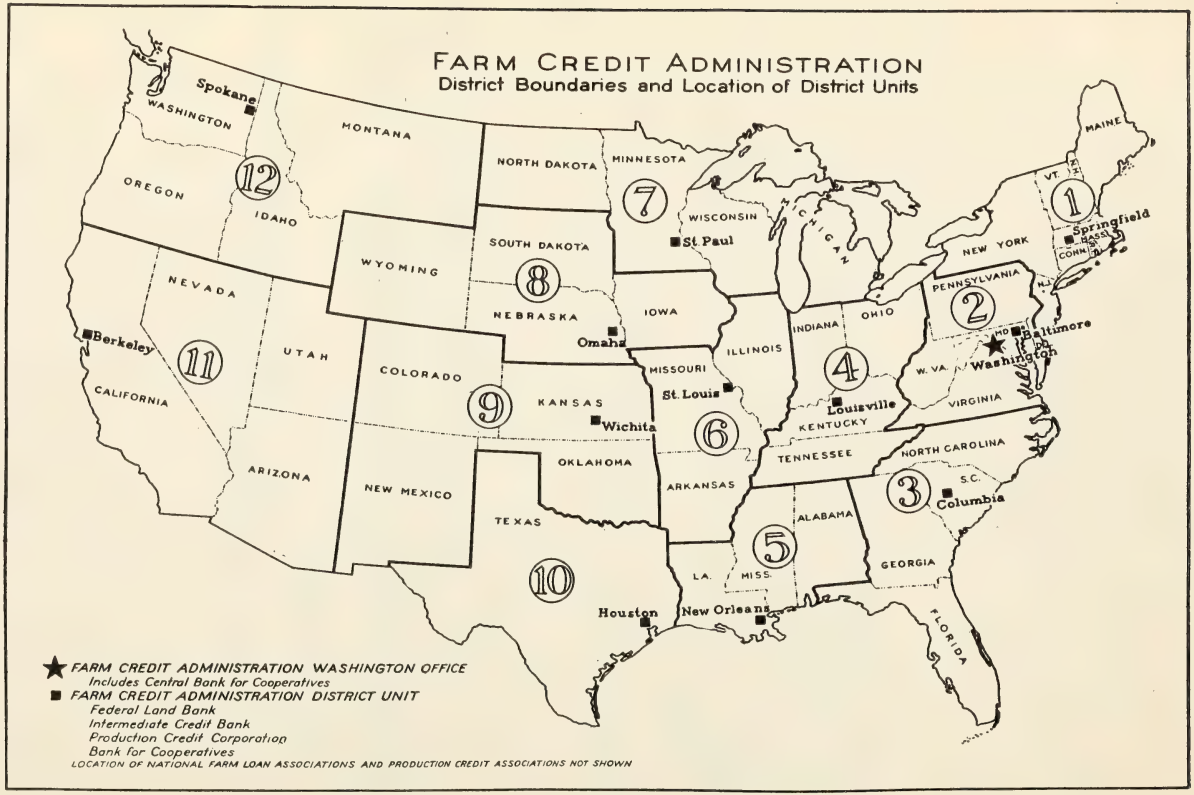

FARM CREDIT ADMINISTRATION
District Boundaries and Location of District Units
Spokane
WASHINGTON
OREGON
IDAHO
MONTANA
12
NORTH DAKOTA
MINNESOTA
7
WISCONSIN
St. Paul
MICHIGAN
MAINE
VT.
1
Springfield
MASS.
CONN.
R.I.
NEW YORK
PENNSYLVANIA
N.J.
2
WYOMING
SOUTH DAKOTA
8
NEBRASKA
Omaha
IOWA
NEVADA
Berkeley
11
UTAH
COLORADO
9
KANSAS
Wichita
ILLINOIS
MISSOURI
St. Louis
INDIANA
OHIO
4
Louisville
KENTUCKY
MD.
Baltimore
D.C.
Washington
W. VA.
VIRGINIA
CALIFORNIA
ARIZONA
NEW MEXICO
OKLAHOMA
6
ARKANSAS
TENNESSEE
NORTH CAROLINA
S.C.
3
Columbia
TEXAS
10
ALABAMA
5
LA.
MISS.
GEORGIA
Houston
New Orleans
FLORIDA
FARM CREDIT ADMINISTRATION WASHINGTON OFFICE
Includes Central Bank for Cooperatives
FARM CREDIT ADMINISTRATION DISTRICT UNIT
Federal Land Bank
Intermediate Credit Bank
Production Credit Corporation
Bank for Cooperatives
LOCATION OF NATIONAL FARM LOAN ASSOCIATIONS AND PRODUCTION CREDIT ASSOCIATIONS NOT SHOWN

FIGURE 1

Summary

IN THE decade ending in 1939 farmers used cooperative credit institutions as a major source of agricultural loans. At the beginning of the period a limited number of farmers had mortgage loans from the cooperative Federal land banks, but these institutions did not constitute a large class of farm mortgage creditors. Today more farmers have their mortgages with the Federal land banks and the Land Bank Commissioner than with any other one class of mortgage creditors. Today, also, the production credit associations organized by farmers under Farm Credit Administration supervision have become an important source of short-term funds for crop and livestock financing. The banks for cooperatives are likewise available to finance farmers' marketing and purchasing and business service associations.

It is estimated that altogether about two million farmers are utilizing directly or indirectly the financing services of institutions operating under the Farm Credit Administration. Credit outstanding at the end of 1939 aggregated more than $3,000,000,000, representing from one-fourth to one-third of the total credit outstanding to agriculture from all sources. The larger part of this credit is extended through institutions that are organized on a cooperative basis.

In the early years of the decade the farmers of this country were faced with the most distressed credit conditions ever experienced by American agriculture. At that time agricultural prices had sunk to such low levels that a large majority of farmers were unable to meet their obligations. Credit institutions were hard pressed for money because of the general financial collapse and were foreclosing farms by the thousands. During the period that directly followed, the Federal land banks not only gave their own member-borrowers every chance to weather the storm, but they refinanced thousands of farmers who otherwise would have been foreclosed. This refinancing, undertaken on the basis of normal values rather than the then existing market prices, enabled farmers to readjust their debts. Many creditors, glad to have a cash settlement, agreed to substantial scale-downs of their claims. Such scale-downs reduced the principal amount of farmers' debts by more than $200,000,000 in the period beginning in the spring of 1933.

But this program had another lasting value in that the farmers refinanced on a sound basis had obtained substantial interest savings that recur each year. These yearly savings of interest brought about by the refinancing program saved farmers millions of dollars in 1939 and will save them substantial amounts in future years.

Mere figures on the number of farmer families refinanced or the amount of money loaned give only a small part of the story. One of the main functions of cooperative organizations is their ability to serve as pacesetters for private creditors. Thus the cooperative mortgage credit system has not only served hundreds of thousands of farmers and their cooperative organizations by providing credit on terms suited to their needs at low interest rates, but it has been successful to a large extent in inducing other financial institutions to improve the terms of their loans and reduce interest rates. Likewise, in the field of short-term credit, the most progressive lenders have followed the lead of the production credit associations. They have begun to make loans on a modified budget basis and they have been led to cut materially their interest charges and other costs as well as take a real interest in the individual farmer's business.

One of the major objectives of the Farm Credit Administration is to assist farm families in reaching the status of farm-home owners free from debt. Farmers made considerable progress toward this objective in 1939. The number of families assisted in financing the purchase of farms turned upward during the year. Existing owners reduced their indebtedness and increased their equities. Principal repayments on land bank and Commissioner loans were considerably larger than in 1938. Also a large proportion of the farmers who are financing their short-term requirements through production credit associations had substantially larger net worths at the end of the year. The aggregate situation improved in spite of droughts and continued low prices for crops which, in some areas, have retarded the normal progress toward farm ownership and freedom from debt.

During the thirties most farmers' commodity cooperatives, like those providing credit, improved their financial position notwithstanding the depression. Through their cooperatives farmers increased their share in the ownership and control of facilities for marketing farm products, purchasing farm supplies, and providing farm business services. Plants and facilities owned and operated by farmer cooperatives for storage, packing, manufacturing, and merchandising are more numerous and better equipped than they were 10 years ago. This is reflected in the financing through the 13 banks for cooperatives which now supply about one-fourth of the credit used by farmers' cooperative organizations; and also by studies of the Cooperative Research and Service Division of the Farm Credit Administration.

Cooperative Farm Mortgage Credit

By assisting in financing farm purchases during the past few years the Federal land banks have made farm ownership possible for thousands of farmers and responsible tenants who otherwise might not have had an opportunity to obtain homes of their own. Most of the new owners made down payments which were modest but adequate to meet the requirements of land bank and Commissioner financing. Some farmers and tenants purchased their farm homes from individuals and financed them through the cooperative mortgage credit system. Others purchased farms directly from the Federal land banks and the Federal Farm Mortgage Corporation.

Approximately 18,000 farmers and tenant families obtained such credit in 1939 to assist in financing farm purchases. During 1939 the amount of such loans totaled $48,000,000 as compared with slightly less than $43,000,000 in 1938. During the last half of 1939 the amount of such loans was considerably ahead of the similar period the year before. More than 80,000 farmers and tenants have bought farms—many for the first time in their lives—since the enactment of the Farm Credit Act of 1935 authorizing Land Bank Commissioner loans to assist in purchasing farms. These farmers have obtained credit in excess of $200,000,000 for this purpose through the land banks.

It is, of course, too early to predict the eventual outcome of this financing. Individual loan reports indicate that a large proportion of the tenants who have bought farms are making good. Young men who inherited equities in farms have utilized this financing to pay off other heirs. Farmers with a few acres have now purchased enough land to make efficient farm units. The new owners should have a better-than-average chance of making good. They have purchased properties during a period of unusually low real estate values. In most instances the loans have been made for periods of twenty- to thirty-odd years at interest rates drastically lower than those available to earlier generations of farmers. In fact interest rates on land bank and Commissioner loans were—and still are—the lowest on record.

Upward Trend in Land Bank Financing

Farmers' requests for land bank and Commissioner loans reached an all-time peak in 1934 primarily because of the depression and the emergency need for refinancing. They then dropped sharply each year through 1938. In 1939, however, lending by the land banks and Commissioner leveled out. The $79,000,000 loaned during the year was only slightly under the previous year; and toward the close of 1939 the volume of financing was higher than 1 year earlier.

In 1933–35 the Federal land banks and Commissioner were swamped with the applications of farmers whose debts had become burdensome

because of low prices and other depression causes. Nearly $2,000,000,000 was loaned in a short period. More than 90 percent of this money was used to refinance existing mortgages and other debts. The largest percentage of loans continues to be made for refinancing, but since 1935 farmers have used an increasing proportion of loans to assist in financing the purchase of land, and for general agricultural purposes, including the financing of buildings and improvements. In the past 3 years the percentage of loan proceeds used to finance farm purchases has been greater than at any time in the history of the farm loan system.

Mortgage Financing by Other Creditors Increasing

The volume of farm mortgages placed on record by all classes of creditors, including the land banks and Commissioner, increased very slightly during the 12 months ending September 1939 for the first time in several years. Since gains during the last part of the year were more noticeable, particularly on the part of commercial banks, a further increase may be expected in 1940. All creditors recorded an estimated $726,000,000 of farm mortgage loans in the 12 months ending September 30, 1939. A considerable portion of the farm mortgages placed on record consists of those refinancing existing mortgage debts, and to that extent does not represent new financing.

With more mortgage funds being obtained in connection with the purchase of farms and equipment, the long decline in the outstanding farm mortgage debt appears to be approaching an end.

The debt dropped steadily from $9,757,000,000 in 1928 to $7,071,000,000 in 1939—the lowest point in 20 years. The percentage of decrease has been progressively smaller over the past few years. The sharp decrease in the farm mortgage debt during the depression and immediately afterward was due largely to farm foreclosures; but since 1935 a considerable part of the decrease has resulted from farmers' repayments on their debts.

Farmers Making Larger Principal Repayments

Approximately 618,000 farmers had Federal land bank loans outstanding on December 31, 1939. The loans totaled $1,905,000,000, representing a decrease of about 3.9 percent compared to 1 year earlier. In spite of low prices for many farm products during the first half of the year, and serious continuing drought conditions in a half-dozen Midwestern States, farmers are now paying off mortgage loans from the Federal land banks at a faster pace than in 1929 or any year since then. In the average case, the farmer repaid in 1939 about $5.70 of each $100 of principal outstanding. In the aggregate,

farmers are also making larger repayments on the Land Bank Commissioner loans.

Total land bank and Commissioner principal payments—including regular installments, special payments, and payments in full—aggregated $156,000,000 during the year, representing an increase of 22.8 percent over 1938. In 7 years since the Farm Credit Administration was organized total principal repayments of all types on land bank and Commissioner loans amounted to more than $574,000,000.

More than 112,000 loans have been paid in full during this period. Of the total number completely repaid about 61,000 were first mortgage Federal land bank loans and 51,000 were first and second mortgage Land Bank Commissioner loans. Payments in full have increased from less than 3,000 loans in 1933 to approximately 27,000 a year in 1939.

Measures for Assistance in Distressed Areas

Largely for the benefit of borrowers in distressed areas, the Federal land banks in September 1939 suspended all foreclosure actions on land bank and Commissioner loans except in certain cases such as those involving abandonment, bad faith, and action to quiet title. This action was taken pending a study of conditions surrounding foreclosures. Meanwhile measures already undertaken for providing every possible assistance to worthy borrowers were extended. The program, begun in 1938, of reamortizing Land Bank Commissioner loans over a longer period of years in cases where such action was needed, was accelerated during 1939. In addition other distressed borrowers were granted extensions and standstill agreements.

National farm loan associations are proving to be of invaluable assistance in this work, enabling the banks to give assistance more quickly to worthy borrowers. By placing the associations on a better basis and providing for larger local responsibility in the making and servicing of loans, the banks have been relieved of much field work—work which the associations can handle more expeditiously and to better advantage for farmers because of their familiarity with local conditions.

Land Bank Commissioner Loans

During the year farmers obtained, through the land banks, 16,400 loans from the Federal Farm Mortgage Corporation—known as Land Bank Commissioner loans. This was a slightly smaller number than in 1938. The Commissioner loans made in 1939 aggregated $27,400,000. These loans are made for the same general purposes as Federal land bank loans, including the purchase of land, refinancing of debts, and for improvements and other general agricultural purposes. However, since the Commissioner's loans are made on second as well as first mortgage security, they are utilized primarily in in-

stances where the security offered is not eligible for a Federal land bank loan or where the amount needed is greater than the land bank is permitted to lend on its first mortgage.

Condition of Commissioner Loans Outstanding

Approximately 440,000 farmers had Commissioner loans outstanding at the close of 1939. The amount outstanding was $691,000,000, or about $62,000,000 lower than at the close of 1938. This reduction was due to the fact that loan repayments and liquidations considerably exceeded the volume of new loans made. Farmers repaid $64,000,000 of principal on Commissioner loans during the year, or 11 percent more than in 1938; and the amount of reduction through foreclosures and voluntary deeds was $22,900,000, or 12 percent less than in 1938.

In considering this record of repayment it should be remembered that most of these loans were made to the more heavily indebted farmers during the period of emergency refinancing when it was recognized that because of the necessity of giving as large a proportion of the farmers as possible a chance to work out, there would be a rather high percentage of farmers who would not succeed in getting out of their difficulties.

Many farmers who have Commissioner loans obtained them in 1933–35 to refinance debts which had grown heavy during the depression. Consequently they had to borrow the maximum allowed under the law—75 percent of the appraised value of the property. In many instances refinancing could be undertaken only after debts had been scaled down by creditors. Commissioner borrowers were allowed a 3-year period in which they were not required to pay principal, and afterward a 10-year repayment period. In general, interest rates on Commissioner loans were lower than the borrowers had been paying previuosly and were accompanied by more favorable loan terms. Most farmers with Commissioner loans were able to carry on and have since made splendid progress in getting out of debt. In a majority of the States all matured installments were fully paid up on from 75 to 80 percent or more of Commissioner loans as of December 31, 1939.

In a number of Midwestern States, however, a succession of drought years following the depression brought total or partial crop failures. Insect damage and low prices for some crops added to the difficulties. Consequently, even with the lighter debt requirements accompanying land bank and Commissioner refinancing, many farmers have found it very difficult if not impossible to meet their payments and the banks in the areas affected have had to take special measures to help worthy borrowers remain on their farms.

In 1938 a beginning was made in reamortizing 10-year Commissioner loans for longer periods, and to the end of 1939 more than 39,800 loans

had been reamortized. Several other plans were made available to borrowers to help them carry on, such as extensions of time and standstill agreements put into effect where it is evident that inability to pay is due to circumstances beyond the borrower's control.

Cooperative Short-Term Credit

Since the establishment of production credit associations in 1933 and 1934 more and more farmers have become members and used their services each year in an effort to increase the efficiency of their farm operations, and thereby improve their financial condition. By the end of 1939 more than 292,000 farmers had become members of their production credit associations.

But the services the production credit associations are rendering to farmers and stockmen cannot be measured alone by the number of members or the loans made. One of their most important contributions has been that of providing competitive standards which other lenders come to recognize. Thus interest rates of private lenders have been dropped far below their former charges to enable them to compete with the production credit associations. They have also found it advisable in many instances to adopt at least a modification of the production credit associations' budget plan and to make some attempt to suit the maturity dates to the time when the farmer expects to sell his crops and livestock. The presence of the production credit associations has also given farmers an assurance of a dependable source of funds to finance any sound operation in bad times as well as good, and has thus enabled them to make plans for long-time operations. Many association members, furthermore, are enjoying the right to independent action in their financing for the first time. No longer do their credit obligations tie up their entire farm operations by controlling their marketing or purchasing activities.

PCAs Show Steady Growth

Accompanying the growth in the number of farmers using this system has come a corresponding increase in the volume of business done, measured in terms of the amount of money loaned. In 1934, for example, the associations lent $107,000,000 during the year and had $60,900,000 outstanding at the end of the year. In 1939 farmer-members borrowed $321,000,000 from the associations and at the end of the year had $154,000,000 outstanding. This brought the total amount of money loaned by the associations since their organization to almost one and a half billion dollars.

Production credit associations during their steady growth have been learning by experience just which loans can be made with safety to the associations and at the same time on a basis which is sound from the

standpoint of helping rather than hurting the individual farmer. They have realized from the start that a loan safeguarded from loss by available collateral may still not be sound from the standpoint of the farmer if it cannot produce sufficient income to repay the loan with interest from the operating income of the farm. If he must sell livestock or equipment needed to operate the farm in order to pay the loan, he will be in poorer condition to make a reasonable living after it is paid off.

Members Better Their Financial Condition

Studies show that as a result of the increasingly successful application of this policy thousands of production credit association members have substantially improved their financial positions. Tenants have been able to build up savings with which to purchase farms. Owners have been able to increase their equities as well as their productive capacities by buying more livestock or land or by building up land already owned. Still other farmers or ranchers with efficient units already established have progressed to the point where they no longer need outside financing. Thus the system has not only enabled a large proportion of its members to successfully carry on each current year's operations, but it has also assisted them in taking definite steps up the ladder of financial independence.

Each year, therefore, the actual growth in services rendered to farmers has been considerably greater than the mere numerical increase in the number of members and the amount of money loaned.

In an effort to make it possible for each association to better serve its farmer-members, the district production credit corporations have been assisting them in carrying on an intensive program to train directors and employees. The program includes a history of short-term credit and the part the cooperative system is playing in its present development, together with a study of credit problems, the improving of efficiency in carrying on everyday operations, and methods of keeping farmer-members and the general public informed as to association policies and activities. The program is helping to build a thoroughly trained personnel—one that is better able to carry on everyday duties and fitted to take over future vacancies in more responsible positions, thus assuring the farmer-members continued efficient service in the future.

A good measure of the interest farmers have in the control of their cooperative credit system is their attendance at the annual meetings of production credit associations. At these meetings they become better acquainted with policies, hear reports on progress, and elect directors. More than 60,000 farmers attended the series of annual meetings in the early months of 1935. Each year since then has

shown an increasing number of farm people attending these meetings. In 1939 the attendance totaled 148,892 farmers. This included 30 percent of the membership.

During the year farmer-members again increased their investment in the capital stock of their local production credit associations. At the end of the year they owned stock amounting to $16,700,000 which was equal to 17 percent of the total capital. In addition the associations have built up out of earnings $14,400,000 in reserves to protect this investment and their members' very source of credit by putting their associations on a strong financial basis.

Interest Rate Reduced

One of the important developments in the field of short-term credit during the year was a reduction in the interest rate from 5 percent to 4½ percent. This followed a reduction in the Federal intermediate credit banks, discount rate from 2 to 1½ percent and reflected the low rates of interest prevailing in the investment markets which enabled the banks to sell their debentures at extremely low rates. The ability of the intermediate credit banks to follow the general downward trend of interest rates is due to a large extent to the production credit associations' and the banks' record of successful operation and low losses.

Losses on the billion and a half dollars loaned by the production credit associations since their organization have amounted to less than one-half of 1 percent. The interest rate reduction was the third since the organization of the production credit associations. The rate was at first fixed at 6 percent, but a series of 2 reductions in 1934 brought it down to 5 percent. The estimated annual savings to farmers on the latest reduction alone amount to more than $800,000.

Discount Funds Available at Unusually Low Cost

In 1939 many farmers and stockmen felt the benefits of unusually low cost funds for financing their seasonal requirements because of the operations of the 12 Federal intermediate credit banks. These banks serve primarily as a wholesale source of funds not only for production credit associations, but also livestock loan companies, agricultural credit corporations, commercial banks, and similar financing institutions to use in making short-term loans to farmers and stockmen for agricultural purposes. After furnishing funds to these institutions at a discount rate of 2 percent during the last 5 years, early in 1939 the intermediate credit banks reduced their discount rate to 1½ percent—the lowest in their history.

The new rate resulted from the ability of the banks to obtain at lower interest cost the funds needed for their operations through sale

of their debentures to private investors. Most of their loan funds are obtained in this manner. The debentures are not guaranteed by the Government as to either principal or interest, but are the joint and several liability of all 12 banks.

The Federal intermediate credit banks extended total credits of approximately $472,000,000 during the year. The amount was slightly larger than in 1938. About 75 percent of the 1939 credits consisted of loans and discounts for production credit associations; 18 percent was credit extended to privately capitalized financing institutions; 6 percent was for commodity loans discounted for the banks for cooperatives; and 1 percent was loans to farmer cooperatives.

The Federal intermediate credit banks have an aggregate capital stock and paid-in surplus of $70,000,000 and $30,000,000, respectively, all of which was provided by the Government. On their 1939 operations, after paying franchise taxes to the Government for the year, amounting to $685,000, the banks increased their earned surplus by $2,055,000, giving a total earned surplus at the end of the year amounting to $16,460,000.

Over the entire period of their operation, going back to 1923, the Federal intermediate credit banks have exended total credits amounting to 4½ billion dollars. The net amount of losses charged off together with reserves for possible losses during the period amounted to less than one-quarter of 1 percent of the credit extended.

Growing Cooperatives Require Credit

During recent years there has been a marked tendency for marketing cooperatives to carry their products nearer to the consumer while purchasing associations have been going farther back toward the original sources of supply for the products farmers use in large quantities. In many instances the stronger cooperatives have expanded their services from either a purely marketing or purchasing function to either a combination of both or to include additional phases of the processing of the products involved. Purchasing cooperatives, for example, have built large feed mills and fertilizer plants and those handling oil and gasoline have constructed oil blending plants, and during the last year the first two cooperatively-owned refineries have been started. This trend toward the assumption of more functions by cooperative organizations has made it possible for them to increase the savings to their members and has given them greater opportunities to improve the quality of the products they handle.

Cooperative organizations now generally recognize that they not only have the opportunity of serving their farmer-members by pro-

viding high quality service at the lowest possible cost but they also provide definite assistance to all farmers by increasing efficiency, improving service, and lowering margins and thus making it necessary for private enterprises to approach the cooperatives' standard of operations. On the other hand the existence of progressive private enterprises tends to keep the cooperatives alert to the possibilities of cutting costs and further improving service.

In addition to the continued growth of farmers' cooperative purchasing activities, during the past few years there has been a marked increase in the number of cooperative cotton gins, particularly in Texas and Mississippi. In Texas a number of cotton gins are overcoming the highly seasonal nature of the business by adding the additional service of purchasing general farm supplies for their members. Several cooperative cottonseed-oil mills also have been established recently.

Accompanying the shift of production of poultry and eggs to the Northeastern States has come a large increase in the number of egg and poultry cooperatives in the region. About half of these are operated as local auctions. The past few years has also seen the establishment of many cooperative cold storage locker plants in Middle Western and Southern States.

It is estimated that the Central Bank for cooperatives and the 12 district banks are now providing about one-quarter of the total credit now being used by cooperative associations. But here again the mere volume of loans is not a true measure of effectiveness because this cooperative source of credit for farmers' organizations acts also as a pace-setter, and its mere existence makes it possible for many associations to borrow from private sources at favorable terms.

During the past few years the increase in effectiveness of many cooperatives is readily traced to their greatly strengthened financial condition and their ability to obtain credit available to other industries on terms suited to their particular needs. This has made it possible for them to progress at a more rapid pace than would otherwise have been possible.

Keeping Control in the Hands of Active Members

Recognizing the necessity of providing means for keeping the control of their associations in the hands of active farmer-members, a number of associations in the past few years have adopted what is known as a revolving capital plan. This plan—which the banks for cooperatives and the Cooperative Research and Service Division of the Farm Credit Administration have wholeheartedly endorsed as widely applicable—provides that the cooperative retain a portion of the selling price over and above running expenses to use as capital for

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operating purposes. When the capital fund has been built up to a point where no additional money is needed, the cooperative continues to keep a proportion of the selling price but retires the no-longer-needed funds by paying off the earliest contributions of its members. In this way the control of the association remains in the hands of the farmers actually using it and in direct proportion to the amount they use it. On the other hand, farmers who have ceased to use the association lose their control and have their capital contributions returned. This, of course, helps to keep up the interest in the cooperative and assists it in maintaining its vitality.

Of considerable importance to cooperatives was the reduction during the year of interest rates charged by the banks for cooperatives for operating and commodity loans from 3 and 2 percent to 2½ and 1½ percent, respectively. These reductions were made at the time the Federal intermediate credit banks reduced their discount rates. This was made possible by the favorable conditions existing in the money markets and the continued successful operations of the short-term lending institutions operating under the supervision of the Farm Credit Administration.

Cooperatives Repay Their Debts

During the year 1939 the banks for cooperatives made a total of 1,180 loans amounting to $83,359,807, which brought the total number of loans made since the banks were organized in 1933 to 6,868, or a total of $491,000,000. At the end of the year, 1,634 cooperative associations were using the financial facilities of the banks for cooperatives and had $76,300,000 outstanding in loans on December 31. Cooperative associations of all kinds have repaid a total of $414,000,000 to the banks since 1933.

During their 7 years of operation in which they have loaned nearly half a billion dollars to farmers' cooperative marketing, purchasing, and business service organizations, the banks for cooperatives have had to charge off approximately six-hundredths of 1 percent of the amount of money loaned. The farmers' organizations using the banks now have a total of $3,487,000 invested in either the banks' capital stock or their guaranty funds. This share in the ownership of the banks by these associations entitles them to a vote in the election of one of the members of the district farm credit board in the case of the district banks, or members of the board of directors of the Central Bank, depending upon the bank from which the association borrows. The farm credit board of each district serves as the board of directors for the bank for cooperatives as well as the Federal land bank, the

Federal intermediate credit bank, and the production credit corporation of the district.

Emergency Crop and Feed Loans

Emergency crop and feed loans are made for short periods to farmers who are unable to obtain loans from other sources. The Farm Credit Administration is authorized to make such loans under authority of an act of Congress approved January 29, 1937; and under subsequent legislation funds were made available for making the loans until June 30, 1940.

Approximately 143,000 loans were made in 1939, amounting to $15,000,000. The number of loans was 18.3 percent smaller than the preceding years.

The general trend of the number of these loans made in each calendar year since 1931–32 has been downward due to the increasing availability of credit from other sources and improvement in agricultural conditions.

The number of loans fluctuates from year to year as a result of changes in the economic status of the type of farmer served by these loans. These changes are due to varying crop conditions and to other factors affecting the individual farmer.

Over the entire period in which emergency crop and feed loans have been made, 1918–39, approximately $376,000,000 has been advanced, 69 percent of which was repaid at the end of 1939.

Organizations in Liquidation

In addition to the supervision of the permanent credit units the Farm Credit Administration has general supervisory power over regional agricultural credit corporations, the Agricultural Marketing Act revolving fund, and the joint stock land banks which are now in the process of orderly liquidation.

Regional Agricultural Credit Corporations

The regional agricultural credit corporations were originally established by the Reconstruction Finance Corporation to make emergency loans to farmers and stockmen who could not obtain credit from other sources. The supervision of these corporations was transferred to the Farm Credit Administration by Executive order in 1933. The corporations were placed in orderly liquidation on May 1, 1934, after the establishment of the production credit associations, which were organized to provide farmers and stockmen with a permanent source

of short-term credit operated on a cooperative basis. The corporations made loans totaling $328,000,000. On December 31, 1939, 2.4 percent of these loans were still outstanding. The liquidation of the corporations had made it possible for them to repay $39,500,000 of the $44,500,000 originally subscribed in capital by the Reconstruction Finance Corporation. These repayments came after the retiring of all the credit extended to them by the Reconstruction Finance Corporation and the Federal intermediate credit banks. Thus the operations of the regional agricultural credit corporations which were established to make emergency loans on which it was anticipated there might easily be substantial losses will enable them to repay all of the capital invested in them by the Government.

Agricultural Marketing Act Revolving Fund

The Agricultural Marketing Act of June 15, 1929, authorized the establishment of a revolving fund of $500,000,000 for the use of the Federal Farm Board in making loans to farmers' cooperative associations and stabilization corporations. By the Executive order establishing the Farm Credit Administration, the administration of the remaining balance of this fund was transferred to the Farm Credit Administration. Active lending operations from the fund were curtailed after the establishment of the banks for cooperatives which were organized on a permanent basis under the Farm Credit Act of 1933. Loans from the revolving fund totaling $87,200,000 remained outstanding on December 31, 1939, as compared with $466,000,000 outstanding when the fund was transferred to the Farm Credit Administration on May 27, 1933. Of the total now outstanding $66,700,000 represents loans to the Grain Stabilization Corporation, now in dissolution. The remainder of $20,500,000 is outstanding in loans to cooperative associations.

Joint Stock Land Banks

Eighty-eight joint stock land banks were established between April 24, 1917, and July 1, 1931, under charters issued by the Farm Loan Board as provided in the original Farm Loan Act. These privately capitalized institutions were granted the power to make long-term amortized farm mortgage loans and to sell tax-exempt bonds to obtain funds for making such loans. The general supervisory powers of these banks were transferred to the Farm Credit Administration in 1933, and they were placed in liquidation at the direction of Congress. At that time the banks had gross assets of slightly less than half a billion dollars. They have now liquidated

approximately 70 percent of their assets and paid off 75 percent of their bonds. During the period 1933–35 many farmers who had loans from the joint stock land banks refinanced them with the Federal land banks.

Federal Credit Unions

While some farmer interest has been evidenced in this form of thrift and loan cooperative, the great advance in Federal credit unions has been manifested in city rather than rural groups. A number of new units were chartered to serve farm families, but at the end of the year more than 95 percent of the 3,197 active Federal credit unions were operating in towns or cities.

Members borrowed about $75,000,000 from their Federal credit unions in 1939, and the assets of Federal credit unions at the end of the year were approximately $47,000,000.

The increase in number, membership, shares, and volume of business which has characterized the growth of these organizations since the Federal act was passed in 1934 shows no signs of leveling off. In 1939, 529 new charters were granted, slightly more than in the year before. Total membership increased more than one-third and is now rapidly approaching the million mark. Total assets were about 60 percent higher on December 31 than the year before, and total loans made showed a similar gain.

With 5 years of steady development behind them, Federal credit unions have now reached the point where instruction of members and perfection of operating practices are as important as further expansion. A large share of the efforts of the Credit Union Section in 1939 was directed toward these objectives.

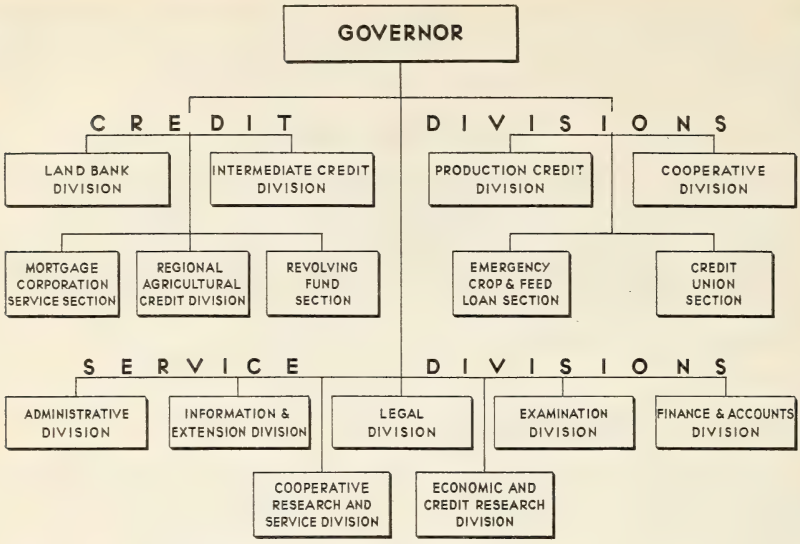


FIGURE 2.—THE WASHINGTON ORGANIZATION OF THE FARM CREDIT ADMINISTRATION

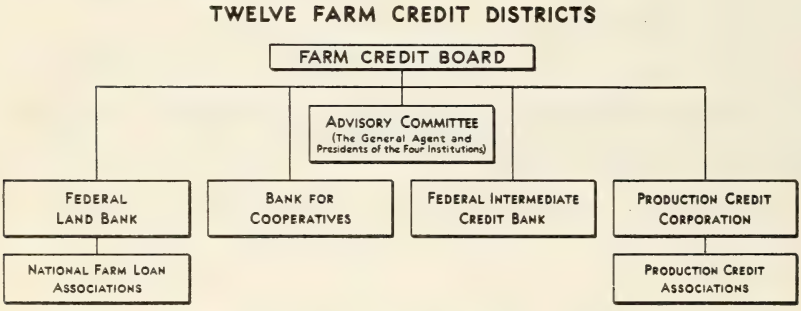


FIGURE 3.—THE DISTRICT ORGANIZATION OF THE FARM CREDIT ADMINISTRATION

Seventh Annual Report

of the

Farm Credit Administration

THE Farm Credit Administration, which was organized in 1933, has under its supervision a Nation-wide system of permament agricultural credit units, and in addition a number of emergency credit organizations. Under the President's first reorganization plan which became effective June 24, 1939, the Governor of the Farm Credit Administration is responsible to the Secretary of Agriculture rather than directly to the President as had been the case since the Farm Credit Administration was organized in 1933, to coordinate the supervision of all institutions making loans to farmers then operating under Federal supervision.

Shortly after the Farm Credit Administration was organized, Congress enacted legislation authorizing it to strengthen and extend the service of the cooperative farm mortgage system which had been operating since 1917. The Farm Credit Administration was also authorized to assist farmers in establishing a Nation-wide system of local cooperative short-term credit units and establish a cooperative credit system for farmer cooperative marketing, purchasing, and business service associations.

For the purposes of making agricultural credit available to farmers, the country is divided into 12 farm credit districts. There is a Federa land bank, a Federal intermediate credit bank, a production credit corporation, and a bank for cooperatives in each district. All 4 institutions operating in each district are located in the same city and building. Offices of the emergency crop and seed loan organizations, with 3 exceptions, also are located in these 12 regional executive centers.

Farmers in each farm credit district have access to farm mortgage loans through their local national farm loan associations. These local mortgage-credit cooperatives handle Federal land bank and Land Bank Commissioner loans. Farmers obtain loans for crop and livestock production from their local production credit associations. These short-term credit cooperatives are supervised by the production credit corporation of the district. Farmers' marketing and purchasing cooperatives may borrow money from the district bank for coopera-

tives. A Central Bank for Cooperatives extending credit to large regional or national cooperatives is located in the Washington office.

The source of loan funds for production credit associations is the 12 Federal intermediate credit banks. These banks, which were authorized in 1923, borrow money from investors and relend it to production credit associations and other eligible credit institutions. To that extent, the banks act as wholesalers of short-term and intermediate agricultural credit. They do not make loans directly to farmers.

F. F. Hill, who succeeded W. I. Myers as Governor of the Farm Credit Administration on September 20, 1938, after serving as Deputy Governor since 1934, resigned on December 20, 1939, to return to the Department of Agricultural Economics at Cornell University. A. G. Black was appointed by the President to succeed Mr. Hill.

S. M. Garwood, Production Credit Commissioner since 1933, resigned on October 1, 1939, to become President of the Production Credit Corporation of Columbia, Columbia, S. C. Mr. Garwood was the first Production Credit Commissioner of the Farm Credit Administration and it was under his immediate direction that the production credit system was established and grew to the point where during the past year it loaned more money than any of the other credit units operating under the supervision of the Farm Credit Administration. Since his resignation C. R. Arnold, Deputy Production Credit Commissioner since 1933, has been Acting Commissioner.

Federal Land Banks

The 12 Federal land banks were established in 1917 under the authority of the Federal Farm Loan Act, as permanent institutions designed to provide long-term farm mortgage credit for agriculture at rates of interest in keeping with the cost of borrowed funds plus a necessary margin for operating expenses.

Federal Land Bank Loans

The Federal land banks may make loans to farmers for their own account only on the security of first mortgages on farm land. Loans may not be made in excess of 50 percent of the appraised normal value of the land mortgaged plus 20 percent of the appraised value of the permanent insured improvements. Not more than $50,000 may be loaned to any one borrower and applications for loans of more than $25,000 must be submitted to the Land Bank Commissioner for approval. Under the provisions of the Farm Credit Act of 1935, land bank loans may be made under certain conditions to corporations

engaged in raising livestock. Prior to that time, only individuals—"natural persons"—were eligible to become borrowers.

Purposes

Land bank loans may be made (*a*) to purchase land for agricultural uses; (*b*) to buy equipment, fertilizers, and livestock necessary for the proper and reasonable operation of the mortgaged farm; (*c*) to provide buildings and to improve farm land; (*d*) to liquidate any indebtedness of an eligible borrower if the debt was incurred prior to January 1, 1937, and to liquidate debts incurred for agricultural purposes without regard to the time when such a debt was incurred; and (*e*) to provide the owner of the mortgaged land with funds for general agricultural uses.

Applications

Since August 23, 1933, the Federal land banks have acted as agents of the Land Bank Commissioner as well as for themselves in the handling of applications and making of farm mortgage loans. The following table shows the number and amount of applications received or reinstated by the Federal land banks from May 1, 1933, through December 31, 1939:

Applications from May 1, 1933 through Dec. 31, 1939

Year	Number	Amount
May 1 to Dec. 31, 1933	502,470	$2,064,897,403
1934	402,829	2,043,653,392
1935	162,968	811,081,485
1936	84,030	375,504,853
1937	60,836	247,985,002
1938	58,719	231,940,745
1939	49,917	199,793,979
Total, May 1, 1933, to Dec. 31, 1939	1,321,769	5,974,856,859

In addition to the 49,917 applications for loans aggregating $199,793,979 received during 1939, there were 12,061 applications for $45,286,515 that had been received prior to January 1, 1939, and had not been disposed of by that date. At the end of the year, 10,525 applications for $40,494,195 were pending, including those which had been approved for loans but were awaiting acceptance by the applicants and those for which the funds had not yet been disbursed. A table showing the detailed disposition of applications during the year follows:

Receipt and disposition of applications for loans during the year 1939

Status or action	Number	Amount
Pending applications outstanding Jan. 1,1939 (approved and unapproved)	12,061	$45,286,515
Received during 1939	49,917	199,793,979
Total	61,978	245,080,494
Disposed of during 1939:		
Rejected by banks, withdrawals and cancelations before approval	21,382	70,054,780
Amount of reduction by banks		20,726,534
Rejected by banks, withdrawals and cancelations after approval	9,320	34,806,135
Applications closed as loans:		
Federal land bank	20,751	51,581,500
Land Bank Commissioner		27,417,350
Total disposed of	51,453	204,586,299
Pending applications outstanding Dec. 31, 1939 (approved and unapproved)	10,525	40,494,195

Loans to Purchase Farms

During the year 1939, the Federal land banks received 9,800 applications for loans from people who wished to obtain loans to purchase land. In their applications they asked to borrow a total of $35,973,290. The Federal land banks and the Land Bank Commissioner made 4,921 loans involving the purchase of land. A total of $17,480,700, or about 23 percent of total loans made during 1939 was allocated to the purchase of land. A considerable proportion of these loans was made to young farmers and tenants who had saved enough money to make down payments on their own farms.

Volume of Loans Made

During 1939, the Federal land banks made 13,624 loans to farmers for a total of $51,581,500, compared with 14,171 loans during 1938 for a total of $51,418,472. On December 31, 1939, there were 618,456 Federal land bank loans outstanding aggregating $1,904,655,014. The number and amount of loans made during 1939 and outstanding at the end of the year, in each State, appear in table 6 of the appendix. Figure 4 below shows the amount of Federal land bank loans made each year, since the date of organization of the banks and the amount outstanding at the close of each year.

Collections

During the year 1939, farmers who have loans from the Federal land banks reduced their indebtedness by making principal payments amounting to $92,450,400. This was considerably in excess of the previous year as the total principal payments for 1938 were $69,586,000.

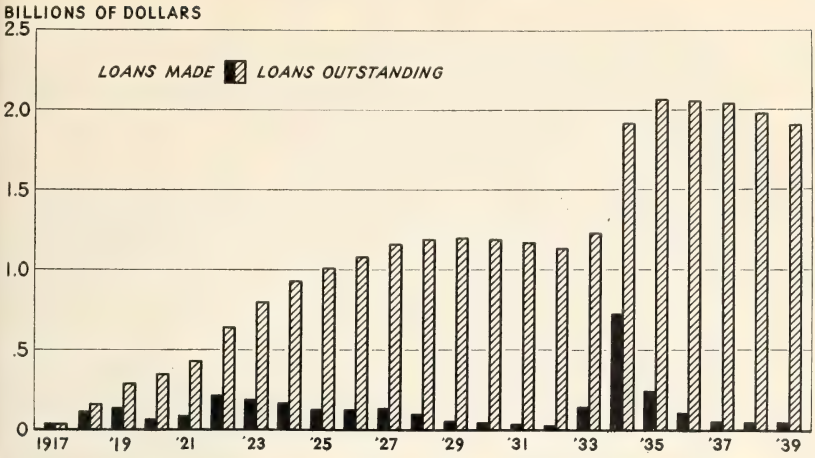


FIGURE 4.—MORTGAGE LOANS MADE BY THE FEDERAL LAND BANKS AND LOANS OUTSTANDING

On December 31, 1939, there was no material change over the previous years in the percentage of loans on which no matured installments remained unpaid, although drought conditions and the crop failures continued over large areas. The following table indicates the status of all land bank loans as of December 31 for the years 1937, 1938, and 1939:

Status of Federal land bank loans outstanding Dec. 31, 1937, 1938, and 1939

Status of loans	Dec. 31, 1937		Dec. 31, 1938		Dec. 31, 1939	
	Number of loans	Percent of total	Number of loans	Percent of total	Number of loans	Percent of total
Classified as not delinquent:						
Loans with all matured installments paid in full	504,652	79.4	484,959	77.1	479,087	77.5
Loans with all unpaid installments extended, with no delinquency in extensions	29,897	4.7	17,931	2.9'	12,287	2.0
Total	534,549	84.1	502,890	80.0	491,374	79.5
Classified as delinquent: Loans with matured installments unpaid and loans with delinquent extensions	101,227	15.9	125,891	20.0	127,082	20.5
Total loans outstanding	635,776	100.0	628,781	100.0	618,456	100.0

Extensions and Reamortizations

The land banks continue to take a long-range view in regard to worthy delinquent borrowers. During the year extensions and reamortizations were granted wherever it appeared to the advantage

of the borrowers and the banks to do so. All cases in which farmers failed to meet their mortgage payments are handled on an individual basis, and if it is shown that the borrower has done his best, has taken proper care of the security, has applied a fair share of his income over and above living and operating expenses to his primary debts, and appears to have a fair chance of working out of a reasonable indebtedness under normal conditions, an extension of his delinquencies over a period not exceeding 5 years, or a reamortization of his entire loan is considered.

Other Treatments

Where the foregoing remedies are not considered adequate for the farmer's needs and the borrower desires to continue with his loan, his situation may be worked out by the use of special forbearance agreements. These agreements provide for two methods of payment, (1) variable payment, or (2) suspended payment. Both methods provide for payments by the borrower which are a reasonable share of the farm income. In either case the agreement extends for 5 years and may be renewed from time to time, and the borrower agrees to pay the taxes. Under the variable payment plan a definite share of the crops, after taxes have been paid, is applied upon the installment falling due. Any unpaid balance in such installment is carried to a suspense account. If there is more than sufficient to meet the installment, the surplus is used to retire the items in the suspense account. This plan is most frequently used in areas where farmers depend on one or two crops for most of their income, and in areas of widely fluctuating production. The suspended payment plan is better adapted to areas of greater diversification where it is difficult to determine equitable payments on a crop-share basis. A definite cash basis is agreed upon, based on the farmer-borrower's ability to pay. Any unpaid portion of each installment is carried to a suspense account. Under the suspended payment plan a normal base income is agreed upon and when the farm income exceeds such normal base, one-half the excess income will be used to retire the items in the suspense account. The variable and suspended payment plans may be applied to land bank, Land Bank Commissioner, or joint loans.

As deferment privileges expired and it became necessary for farmers to make principal payments on loans, and as the market prices for farm products declined, it became apparent that some additional devices would be necessary to aid worthy farmer-borrowers in spanning the long period of subnormal income; so the variable payments, suspended payments, and standstill plans were developed. Pending the time when these plans could be made fully operative and applied through the servicing national farm loan associations, the banks with-

held all foreclosures except those involving bad faith, abandonment, or irreparable loss, until each case could be studied by the associations in the light of the new plan of treatment.

Conditional Payments

Conditional payments which permit farmers who have land bank loans to build up reserves out of which subsequent installments may be paid and on which the bank pays interest, increased from $43,508 at the end of 1938 to $162,070 a year later. This increase is concentrated primarily in the areas not affected by drought and crop failures during 1939 and previous years, and it indicates that considerable volume may be anticipated as farming conditions throughout the 12 farm credit districts improve.

Real Estate

The problem of servicing and selling farm real estate continues to be one of major importance to the Federal land banks. During the last few years there has been a tendency for the banks to have a larger proportion of their real-estate holdings in areas where market conditions have been unsettled for a considerable period. This shift in farm holdings has intensified the bank's real-estate problem. Although it is considered desirable from the standpoint of the communities as well as the banks to promptly place acquired farms in the hands of owner-operators, who will improve and cultivate the properties, the banks have endeavored to avoid dumping farms on the market indiscriminately at unreasonable prices. In developing a higher proportion of owner-operated farms in the communities, the banks are increasing their sales to farm tenants, such sales during 1939 approximating 40 percent of all sales made. In addition, the banks are increasing their sales to former owners both through contract to purchase and through leases with option to purchase.

During 1939, the banks sold or otherwise disposed of 10,576 farms or parts of farms for a total consideration of $26,702,826. This compares with 11,510 farms or parts of farms sold in 1938 for a total consideration of $26,133,445. Although the total number of sales during 1939 was less than the previous year, the sales made by 6 of the banks increased substantially during the period. The decrease in the number of disposals in some districts is attributed to the great reduction in their real-estate inventory during the previous 2 or 3 years which left these banks with fewer farms to offer for sale. The trend in the number of farms disposed of by quarter-year periods is indicated in figure 5.

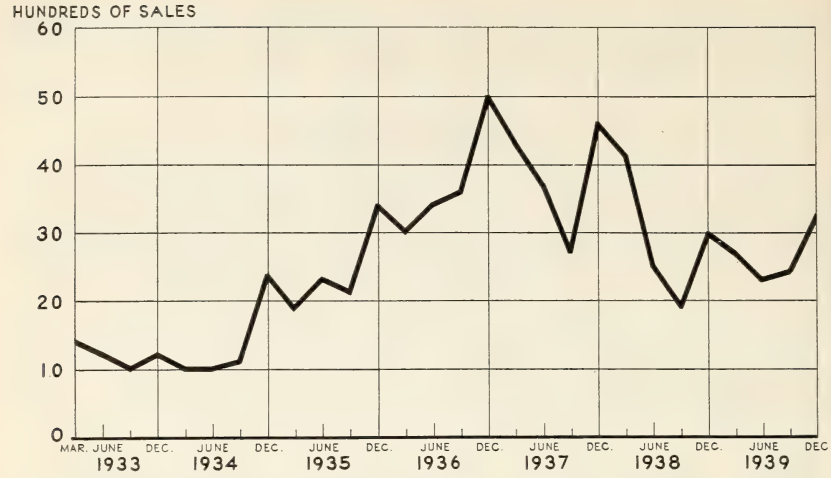


FIGURE 5.—NUMBER OF FARMS SOLD BY THE FEDERAL LAND BANKS IN THREE-MONTH PERIODS

On December 31, 1939, the Federal land banks owned either outright or subject to redemption 25,800 farms with a carrying value of $80,862,063, compared with 24,024 farms with a carrying value of $78,514,974 owned outright or subject to redemption at the end of 1938. A summary of real-estate activities of the 12 Federal land banks during each of years 1936 to 1939 is given below:

Farms, sheriff's certificates, and related items acquired and disposed of by the Federal land banks during 1936, 1937, 1938, and 1939

Item	1936	1937	1938	1939
Acquisitions:				
Number	14,652	9,969	8,414	11,358
Investment	$56,686,891	$36,859,995	$32,341,697	$47,804,388
Disposals:				
Number (including parts of farms)	15,021	15,280	11,510	10,576
Investment	$47,409,011	$49,354,988	$36,101,011	$38,496,073
Consideration	$35,227,788	$37,805,652	$26,133,445	$26,702,826
Average percent cash received at time of sale	19.3	21.4	17.4	16.0

Additional information with respect to the real-estate activities of each of the banks during 1939 are given in tables 11 and 12 of the appendix.

Land Bank Operations

During the year greater emphasis has been placed upon the study of organization and internal procedure of the banks with the view of increasing the efficiency of operations and decreasing costs. This work has been carried on in cooperation with the officers of the banks by making detailed studies of operations and comparative studies of certain phases of operations and organization in the banks. These studies have resulted in modifications and changes in methods of operations and internal procedure as well as in changes in organization.

Finance

During 1939 the Federal land banks did not enter the investment market for new funds since repayments on outstanding loans were more than sufficient to take care of lending requirements. Principal repayments including loans paid in full amounted to $92,450,413 during 1939, which is $22,864,332 more than the banks received in the previous year. The banks loaned $51,581,500 in 1939, compared with $51,418,472 in 1938. The total volume of Federal land bank loans outstanding at the end of 1939 amounted to $1,904,655,014, representing a net decrease for the year of $77,568,993, as compared with a net decrease of $53,082,741 in 1938. Funds not necessary for making new loans were used to reduce the banks' outstanding indebtedness to the extent of $83,501,280. In addition, investments in Government securities increased by $21,932,500 during the year and amounted to $86,661,500 on December 31, 1939.

The condition of Federal land bank loans at December 31, 1939, was practically unchanged from that at the close of 1938. Loans with all matured installments fully paid by borrowers represented 77.5 percent of the total number outstanding on December 31, 1939, as compared with 77.1 percent the year before. The total investment in real estate, sheriffs' certificates, and loans called for foreclosure on December 31, 1939, was $145,654,207, as against $144,426,591 at the end of 1938.

The changes in the financial condition of the 12 Federal land banks during 1939 are indicated in the accompanying condensed statement which shows the principal assets and liabilities of the banks as of December 31, 1938, and December 31, 1939:

Principal asset and liability items of the Federal land banks, Dec. 31, 1938 and 1939

	Dec. 31, 1938	Dec. 31, 1939
ASSETS		
Mortgage loans	$1,976,716,564	$1,896,213,257
Purchase money mortgages and contracts	87,994,164	95,015,980
Unmatured extensions	6,661,456	4,999,409
Delinquent installments [1] [2]	35,407,694	40,476,864
Accrued interest receivable (not due)	28,993,680	27,674,983
Cash and Government securities	101,174,802	139,102,573
Due from the Secretary of the Treasury	9,634,824	8,424,207
Real estate	99,769,463	105,207,140
Sheriffs' certificates, etc	15,786,529	20,687,186
Loans called for foreclosure, judgments, etc	28,870,599	19,759,881
Other assets	14,387,461	14,614,046
Total assets	2,405,397,236	2,372,175,526
LIABILITIES		
Farm loan bonds outstanding [3]	$1,762,054,000	$1,742,834,940
Matured obligations	4,877,207	2,940,142
Notes payable	40,348,000	4,556,400
Accrued interest payable (not due)	19,505,496	19,072,555
Other liabilities	13,842,456	14,878,893
Valuation reserves	64,279,208	72,003,194
Capital stock	238,289,711	236,475,965
Paid-in surplus	183,309,627	187,875,360
Legal reserve	49,868,054	56,921,682
Reserve for contingencies	18,529,323	19,994,204
Earned surplus	5,000,000	5,000,000
Undivided profits	5,494,154	9,622,191
Total liabilities	2,405,397,236	2,372,175,526

[1] Partial payments deducted.

[2] Includes interest and principal installments, matured unpaid extensions, installments on purchase money mortgages and contracts, and tax, insurance, and other items due from borrowers.

[3] Excludes bonds on hand.

A more detailed consolidated statement of condition appears as table 21 in the appendix.

Bond Retirements

During 1939 the remaining individual Federal farm loan bonds which were outstanding in the amount of $737,280, bearing an interest rate of 4½ percent, were called for payment. Cash on hand was used to meet these retirements. With the call for payment of the last issue of individual bonds on July 1, only consolidated Federal farm loan bonds remain outstanding. None of the consolidated farm loan bonds outstanding are callable prior to July 1, 1943.

The following table summarizes the changes in the amounts of all farm loan bonds outstanding during the year 1939:

Amount of consolidated and individual Federal farm loan bonds issued and retired in 1939, and amounts outstanding on Dec. 31, 1938 and 1939

Item	Individual farm loan bonds	Consolidated farm loan bonds	Total
Bonds outstanding Dec. 31, 1938	$737,280	$1,813,100,240	$1,813,837,520
Less bonds on hand Dec. 31, 1938	29,620	51,753,900	51,783,520
Net bonds outstanding Dec. 31, 1938	707,660	1,761,345,340	1,762,054,000
Bonds issued during 1939		6,100,000	6,100,000
Bonds retired during 1939	737,280	53,072,400	53,809,680
Bonds outstanding Dec. 31, 1939		1,766,127,840	1,766,127,840
Less bonds on hand Dec. 31, 1939		23,292,900	23,292,900
Net bonds outstanding Dec. 31, 1939		1,742,834,940	1,742,834,940

The amount of farm loan bonds outstanding at the end of each year from 1930 to 1939, classified according to interest rates, and the average interest rate prevailing during each year, are presented graphically in figure 6.

The Federal land banks are jointly and severally liable for the payment of principal and interest on consolidated farm loan bonds; such bonds are not guaranteed in any way by the Federal Government.

In the collateral statement which appears in appendix table 16, it will be noted that collateral pledged as security by the Federal land banks for outstanding consolidated farm loan bonds and for matured or called individual farm loan bonds amounted to $1,907,824,921 on

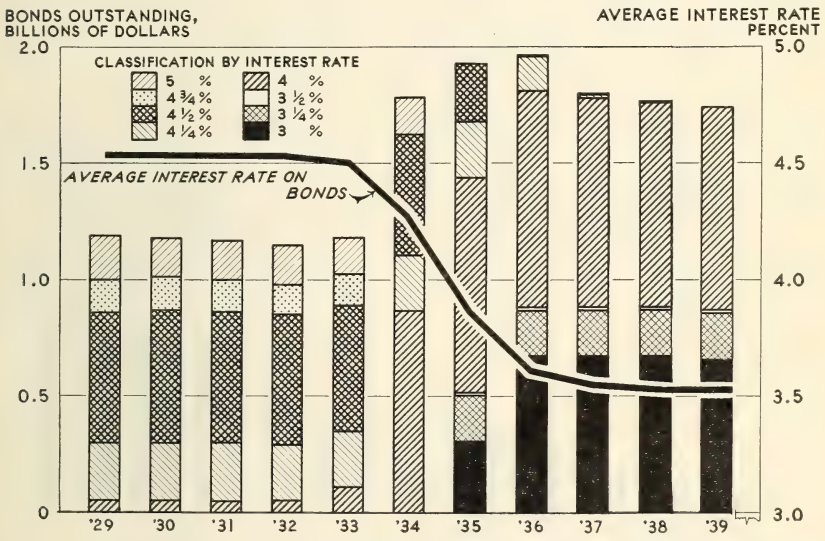


FIGURE 6.—FARM LOAN BONDS OUTSTANDING AND THE AVERAGE INTEREST RATE THEREON

December 31, 1939. Bonds outstanding, including bonds on hand and bonds matured or called, amounted to $1,768,307,415, resulting in an excess in pledged collateral of $139,517,506.

Notes payable by the Federal land banks were reduced during the year 1939 by $35,791,600, leaving a balance of such indebtedness amounting to $4,556,400 at December 31, 1939. All notes in favor of the Federal Farm Mortgage Corporation were completely paid off during the year.

Capital

The outstanding capital stock of the Federal land banks on December 31, 1939, aggregated $236,475,965. Of this amount national farm loan associations owned $107,786,870, or 45.6 percent, the United States Government owned $125,000,000, or 52.8 percent, and the remainder of $3,689,095, or 1.6 percent, was owned by farmers who have borrowed directly from banks and by those who have borrowed through agents. This is shown graphically in figure 7.

Under an amendment to the Federal Farm Loan Act, approved January 23, 1932, the Secretary of the Treasury on behalf of the United States subscribed to $125,000,000 of additional capital stock in the Federal land banks. This stock is to be retired in the same manner as the original stock except that 25 percent of the proceeds of stock subscribed by direct borrowers also is used to retire Government-owned stock. In addition, however, the law provides that all repayments on account of such stock shall be held in the Treasury of the United States as a revolving fund from which further subscriptions to capital stock may be made.

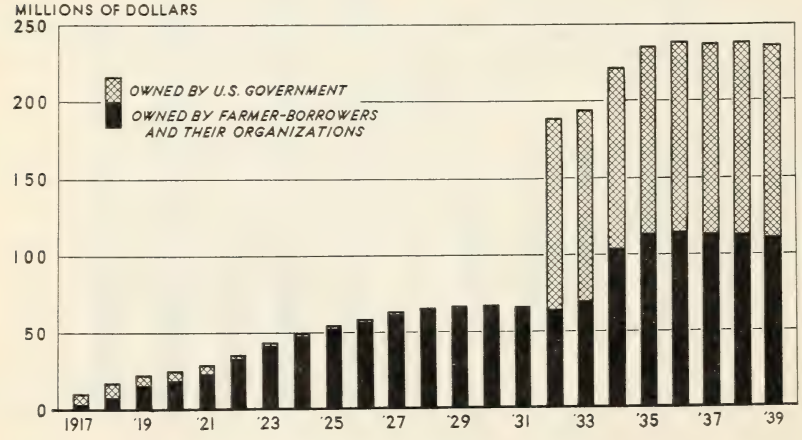


FIGURE 7.—OWNERSHIP OF FEDERAL LAND BANK STOCK

During the year 1939, repayments to the fund totaled $6,091,195 and resubscriptions to capital stock amounted to $6,130,945. Appendix table 17 shows the amount of capital stock in each Federal land bank owned by various classes of stockholders at December 31, 1939.

Paid-in Surplus and Reserves

Under the provisions of the Emergency Farm Mortgage Act of 1933, which enable the banks to extend the loans of worthy borrowers, who are faced with temporary difficulties, the United States Government during 1939 continued to subscribe to the paid-in surplus of the banks. In accordance with the Farm Credit Act of 1937, the unexpended

Condensed profit and loss statement of the Federal land banks

	1938	1939
EARNINGS		
Interest on mortgage loans	$101,642,605	$97,681,291
Interest—Other	9,388,519	8,243,276
Other income	543,042	426,683
Total	111,574,166	106,351,250
DEDUCTIONS FROM EARNINGS		
Interest expense	64,165,192	62,235,893
Operating expense	13,064,969	13,013,699
Total	77,230,161	75,249,592
Net operating earnings	34,344,005	31,101,658
OTHER EARNINGS		
Mortgage loan and real estate transactions	877,738	1,512,597
Premium and discount on securities (amortized), and profit on securities transactions	824,103	337,451
Miscellaneous	380,392	186,930
Total	2,082,233	2,036,978
OTHER DEDUCTIONS		
Mortgage loan and real estate transactions	9,591,270	11,649,959
Premium and discount on securities (amortized), and loss on securities transactions	1,033,203	1,118,145
Miscellaneous	69,459	
Total	10,693,932	12,768,104
Net profit before adjustment of reserves	25,732,306	20,370,532
Adjustment of reserves (net)	12,868,843	7,723,986
Adjustment—Deferred income on real estate sales	+3,115,060	
Total adjustments	9,753,783	7,723,986
Net profit after adjustment of reserves	15,978,523	12,646,546

balances of funds totaling $189,000,000 appropriated by Congress for subscriptions to paid-in surplus, and all repayments of such subscriptions were to be held in the Treasury as a revolving fund. Subscriptions to paid-in surplus during 1939 amounted to $6,884,050 and repayments by certain banks to the revolving fund amounted to $2,318,317. As of December 31, 1939, the total paid-in surplus of the banks amounted to $187,875,360.

During 1939 the banks continued to set aside earnings in the general reserve maintained against the total of mortgage loans, purchase money mortgages, real estate sales contracts, and items related to these accounts, such as installments, extensions, and advances. The purpose of this reserve is to take care of losses arising from these assets and the amount of earnings transferred to the reserve is determined on the basis of the loss experience of each bank. At the beginning of 1939 this reserve totaled $18,595,767. During the year, $19,280,316 was transferred to it and charges against it aggregated $17,223,481, leaving a balance of $20,652,602 on December 31, 1939.

A consolidated profit and loss statement of the Federal land banks for the year 1939 appears as table 22 in the appendix. The preceding condensed statement compares the earnings for 1938 and 1939:

Valuation reserves, paid-in surplus, legal reserves, reserve for contingencies, earned surplus, and undivided profits aggregated $351,416,631 on December 31, 1939, which was $24,936,265 in excess of the amount in these accounts on December 31, 1938.

Interest on mortgage loans decreased $3,961,314 in 1939 while operating expenses, including interest expense, were $1,980,569 less than in the previous year.

Appraisals

At the present time, there are 485 land bank appraisers employed by the Farm Credit Administration, of which 433 are field appraisers and 52 are in supervisory positions, including engineering work. The field appraisers appraise properties in connection with loan applications, partial releases, real estate acquired, and miscellaneous assignments.

It is the work of the Appraisal Subdivision in the Washington office, through its supervisory and reviewal staff, to apply the adopted level of farm commodity prices and the principle of normal land values to all types of farming in all parts of the country. In this connection, the work of all field appraisers is carefully reviewed by reviewing appraisers stationed in the several farm credit districts. Special engineering and farm management problems throughout the country are carefully analyzed by a staff of specialists in order that loan service may be extended wherever it is possible to do so on a sound

basis. During the past year, special studies have been conducted in connection with the development of lending policies in the range territory where rights to graze on the national forest and the public domain are a factor in ranch operation. Progress has also been made in the development of appraisal and loan policies on special types of farms.

With the cooperation of the Soil Survey Division of the Bureau of Plant Industry, a series of soil manuals are being worked out for the respective farm credit districts. Three such manuals have already been issued and others are in preparation. These manuals represent a comprehensive statement on the classification of the soils within the district and other pertinent information that is expected to be helpful to the appraiser in handling his field appraisal problems.

The Appraisal Subdivision is working out a careful classification of loan areas. The areas are classified according to the conditions that normally may be expected to prevail so that credit may be extended on a basis that is consistent with the factors that give reasonable assurance that the loans can be repaid. Such classifications enable appraisers to express their conclusions more accurately in their appraisal reports, and should result in a more consistent extension of credit.

During the past year, arrangements have been made through the Civil Service Commission for the recruiting of appraisers by the establishment of an apprentice grade of land bank appraiser. This will mean that farm boys who have had the advantage of agricultural college training, and especially those who in addition have had some practical credit experience, will be employed and given training in every department of the bank, including field work of all kinds, with the expectation that when they have become acquainted with the principles and practices of rural credit they will become land bank appraisers. Special courses of training are being developed for such men.

Land bank appraisers are discussing the principles of appraising land and their application to the work of the associations in the conferences with officers and directors of national farm loan associations. Numerous appraisal conferences also have been held with agricultural college specialists and vocational agricultural teachers and their supervisors.

National Farm Loan Associations

National farm loan associations are cooperative credit organizations, chartered and supervised by the Farm Credit Administration in accordance with the provisions of the Federal Farm Loan Act, as

amended. They are organized by groups of farmers uniting for the purpose of obtaining long-term mortgage credit suited to their needs and the needs of their community at the lowest rate of interest obtainable.

The local association endorses the loans of its members obtained from the Federal land bank. Members acquire an interest in their local association and assume mutual responsibilities by subscribing to its stock in amounts equal to 5 percent of their loans. This stock is pledged with the association as collateral security for the loans. The association in turn purchases an equal amount of stock in the Federal land bank. The land bank stock is pledged with the bank as additional collateral to secure the association's endorsement of the loans the bank makes to its members. As of December 31, 1939, there were 3,722 operating national farm loan associations.

Reestablishing Association Responsibility

The general program for developing responsible cooperative farm loan associations as contemplated by the Farm Loan Act was continued during 1939. The program's objective is to have the associations assume the responsibility of servicing the loans made to their members and the real estate acquired in connection with loans as well as performing related functions. The decentralization of these activities, formerly undertaken by the land banks, provides an effective and economical means of servicing loans endorsed by the associations for their members and of working out the credit problems of the associations' members in the best interest of all concerned. In assuming these responsibilities, the associations undertake to conform to certain standards so that the job will be done effectively and economically. The banks agree to make allowances available to those associations which properly assume these responsibilities so that the associations may function on a sound business basis and have sufficient income to enable them to meet the expenses of discharging their added duties. On December 31, 1939, 3,486 of the 3,722 operating associations had undertaken the servicing plan.

During the period prior to 1933, many local groups of farmers formed their own national farm loan associations without giving a great deal of consideration to the question of normal trade areas. Consequently, many associations were organized to serve overlapping territories. Experience has shown that where there are a number of national farm loan associations in an area, they usually can operate more efficiently and economically when they are grouped together and use the same office, the same clerical help, and the same secretary-treasurer. Therefore, in order to develop sound economical servicing

units and to eliminate overlapping territories, the banks have made arrangements with two or more associations located in the same logical trade area to perform the servicing job by establishing one joint office and employing a single secretary-treasurer. Although each association continues to function as a separate organization under the direction of its own board of directors, all the associations involved in a particular group mutually agree to select the same individual as secretary-treasurer and to maintain a joint office. Associations, of course, are not required to enter a group management arrangement. The banks thoroughly study the local situations and offer suggestions for grouping while the associations determine whether or not their interests will be served better by accepting the plan, but where the plan is accepted, it generally results in reducing the expenses of the land bank and the national farm loan associations.

The following table shows the number of associations in all farm credit districts operating under servicing plans, individually and in group management arrangements as of December 31, 1939:

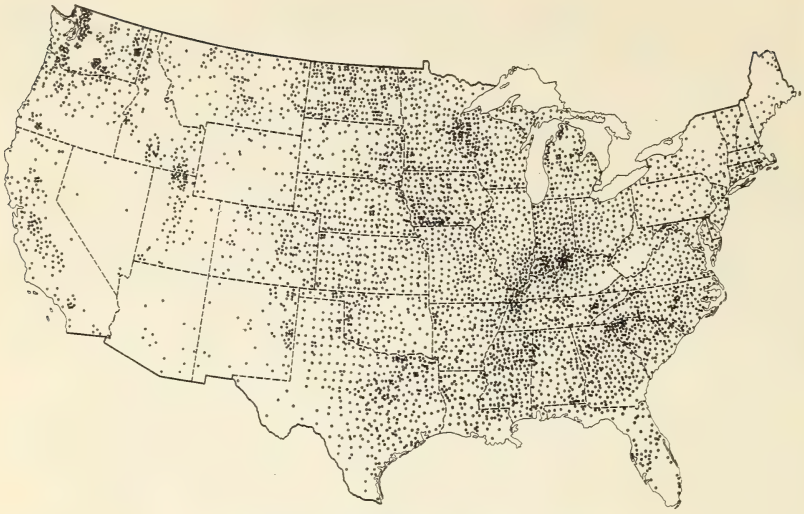
Type of operation	Associations, Dec. 31, 1939	Offices, Dec. 31, 1939
Single allowances	828	828
Group management arrangements	2,658	820
Total	3,486	1,648

Another phase of the association program has been the development and completion of consolidation projects whereby two or more associations are consolidated into a single association. Such projects have resulted in establishing stronger individual associations. In completing the projects, due regard is given to the interest of the respective groups of stockholders involved so that no group of stockholders benefits to the detriment of another group of stockholders. During 1939, 161 consolidation projects were completed, involving 456 associations. Since the inauguration of the consolidation program in November 1935, 531 such projects involving 1,525 associations have been completed, resulting in a reduction of 994 associations. On December 31, 1939, there were 12 consolidations involving 30 associations pending which had received tentative approval and were awaiting action by the associations' stockholders.

Rebuilding Associations

During 1939, a program designed to place associations on a sound self-supporting basis and to generally improve the associations' operations and financial condition was continued. Closer contact and

Location of Offices on June 30, 1935



Location of Offices on June 30, 1939



FIGURE 8.—THE NUMBER OF NATIONAL FARM LOAN ASSOCIATION OFFICES HAS BEEN GREATLY REDUCED IN THE LAST FEW YEARS AS A RESULT OF THE ESTABLISHMENT OF JOINT OFFICES BY 2 OR MORE ASSOCIATIONS

greater cooperation with the Federal land banks and the Farm Credit Administration have resulted from these activities thereby generally increasing the usefulness of the associations. The objective of the program is to assist each association to become a well managed, soundly financed, self-sustaining credit institution, owned and controlled by the farmers who use it. The allowances plans, group management arrangements, and consolidation projects have definitely served to effect this objective.

Section 25 (b) of the Farm Credit Act of 1937 provides a means of effecting the rehabilitation and continuing the usefulness of associations whose capital stock has become impaired. This section of the act permits the Farm Credit Administration to authorize the Federal land banks to make loans to farmers through associations whose capital stock has become impaired through losses. In such cases the new members and the old members of the associations become separate groups with separate issues of stock. Earnings from operations are allocated between the groups, reserves are set up separately and there is no intergroup liability except for operating expenses. The new members pay a rate of interest one-fourth of 1 percent below the rate on direct loans. When there are 10 or more members in the new group with loans aggregating not less than $20,000 in good standing, the interest rate is further reduced one-fourth of 1 percent after the next installment payment date.

Associations operating under section 25 (b) are thus provided with income from fees on new loans which would not otherwise be available. In addition, farmers are able to obtain loans at the lower interest rate available through national farm loan associations. During 1939 the Farm Credit Administration authorized the Federal land banks to make loans through 239 associations under these provisions of the law. In 9 instances, impaired associations returned to a satisfactory financial condition by reason of the removal of the impairment in value of the capital stock of the old group of association members. As of December 31, 1939, 751 associations were operating under section 25 (b) of the Farm Credit Act of 1937. The land banks made 2,597 loans to farmers for $8,563,600 under this section of the act during 1939. This was 19.1 percent of the total number of loans made by the banks and 16.6 percent of the amount of money loaned.

Associations Operating under Conservatorships

Section 25 (d) of the Farm Credit Act of 1937 authorized the Farm Credit Administration to appoint conservators for associations whose capital stock has become impaired. One of the purposes of the conservatorship proceedings is to determine whether an association may be permitted to pay off retired capital stock at its fair book value when loans, in connection with which the stock was originally issued, are paid in full and to settle on the same basis claims of former stockholders who had paid their loans in full but have not received the proceeds of their association stock.

The fair book value of the stock is fixed by the Farm Credit Administration upon the basis of the conservator's report and the recommendation of the Federal land bank of the district. If the report of

the conservator is approved, the conservatorship may be terminated and the affairs of the association returned to its board of directors.

During the year 1939 conservators were appointed for 23 associations. In 16 instances the conservatorships were terminated and the associations permitted to pay off stock at its fair book value and resume the transaction of business. Conservatorship proceedings were not completed in the remaining seven cases.

Generally, when associations were permitted to pay off their stock at its fair book value, the Farm Credit Administration authorized the Federal land banks to make loans through them under the provisions of section 25 (b) of the Farm Credit Act of 1937. This procedure afforded the associations the opportunity to regain a sound financial condition.

Direct Loans

The Federal land banks are authorized to make loans directly to farmers in localities not served by national farm loan associations which are eligible to make loans. The interest rate on such loans is one-half of 1 percent higher than on loans made through national farm loan associations. During 1939, the Federal land banks made 530 loans direct to farmers, amounting to $1,712,200, representing approximately 3.9 percent of the number and 3.3 percent of the total amount of the Federal land bank loans made during the year. Direct loan areas are being reduced to a minimum in order to make loans available to farmers at the lower interest rate obtainable through national farm loan associations. Studies were made by the Farm Credit Administration and by the various banks during 1939 and plans have been worked out for making the facilities of eligible associations available to the largest possible number of farmers.

Educational Program

The development of an understanding of the general principles of cooperative credit among the members, officers, and employees of national farm loan associations, the employees and officers of Federal land banks, the district Farm Credit directors, nonmember farmers, and the general public, has been the objective of the educational work carried on by the Farm Credit Administration. Special attention has been given to membership relations in national farm loan associations and the development of educational activities of interest to the other groups. If, however, the system is to operate successfully on a decentralized basis, which is the ultimate goal of the Farm Credit Administration, it becomes necessary to provide more specific educational and training programs for the groups in the local communities

who are responsible for the success of the decentralization program. This includes those bank employees who are training association personnel, the secretary-treasurers, and other employees of national farm loan associations, and the association directors. Such programs are included in the educational project which has been drawn up during the year.

The fact that usually only a minority of the members take part in association activities makes it even more important that those who do be thoroughly informed on the policies and operations of their association and the land bank. The annual stockholders' meeting is the one opportunity annually for the members to meet as a group to review the activities of their association. Under the circumstances, much stress has been placed in the past and will continue to be placed in the future upon the development of a satisfactory program for each national farm loan association annual meeting. The ultimate goal is to have the associations plan and conduct their own meetings without assistance from the land bank. In order to help the banks and the associations achieve this goal, the Land Bank Division distributed to the banks a booklet entitled "Developing and Conducting Effective National Farm Loan Association Annual Stockholders' Meetings" with the suggestion that certain parts of it be adapted to conditions in their particular district and distributed to the associations. The material included in this booklet is based on the best ideas and experience of the various banks.

Although member attendance is some indication of the success of an annual meeting program, even greater stress is placed on the improvement of the quality of meetings. During 1939, 18 percent of all members attended the annual meetings of their national farm loan associations. This was the same percentage which attended in 1938. However, during 1939 the total attendance was 183,169 people compared with 167,150 in 1938 or an increase of 16,019. The total attendance includes members and all others present, including borrowers from the Land Bank Commissioner.

New Business

During the rush years of 1933, 1934, and 1935 the facilities of the land banks were taxed to an extent which prevented aggressive new business educational work. No particular effort was required on the part of the banks or the associations during that period to get new business. However, since the passing of the emergency period when so many farmers had to find a new source of credit, the volume of new loans has been greatly reduced.

Recognizing the fact that every cooperative needs a constant flow of good new business in order to exist, the Land Bank Division, during the year, wrote and distributed to the land banks an outline of the steps that needed to be taken entitled "The Acquisition of New Business by the Federal Land Banks and National Farm Loan Associations." The outline was prepared in an effort to assist the banks and associations in conducting an educational program which will let farmers know of the advantages of long-term cooperative credit.

Credit and Appraisals

The need for intensive training in appraisal and credit matters on the part of national farm loan association representatives has been apparent for some time. To assist the banks and the land bank appraisers in this connection, suggestions entitled "Conducting National Farm Loan Association Appraisal Studies" have been prepared by the Land Bank Division. The first part includes suggestions to the banks on holding meetings or conferences with selected national farm loan associations to discuss appraisal and credit problems. The second part is a "Manual of Appraising for Use by National Farm Loan Associations." The purpose of the manual is to outline for the associations the principles of extending sound credit and good appraisal practices. It is hoped that through the use of the manual, common ground for the consideration of applications for loans will be reached by associations, land-bank appraisers, and the banks.

Association Business Review Program

The progress of the decentralization program to date indicates that association directors will maintain interest in association affairs only if they are given responsibility. Since no responsibility was carried by the associations for such a long time it is to be expected that many boards of directors have not devoted themselves seriously to the consideration of association problems. This situation exists largely because the directors have not been fully informed as to their responsibilities and duties. Because special training in association management, loan and real-estate servicing, and the application of delinquent loan remedies and policies is necessary for the directors to function satisfactorily, special educational efforts to include them are being made.

The experience of the banks indicates that properly conducted meetings at which the business of the association is reviewed offer a solution to the problem of training association officials to cope with loan, real-estate servicing, and association-management problems.

These conferences between a bank representative and the association board of directors, at which discussions are conducted on a case basis, provide an ideal opportunity for a discussion and application of all policies, procedures, and practices in which the association and the bank are mutually interested. Suggestions to the banks for conducting such meetings have been prepared by the Land Bank Division and entitled "Organizing and Conducting a National Farm Loan Association Business Review Program."

Production Credit System

The Farm Credit Act of 1933 provided for a cooperative production credit system to furnish adequate credit facilities adaptable to the special short- and intermediate-term credit needs of agriculture. It is a system designed to give farmers and stockmen credit equality with commerce and industry by giving them access to the investment markets.

The Production Credit Division of the Farm Credit Administration, under the supervision of the Production Credit Commissioner, has devoted its full time during the current year to refining policies and procedures and in assisting the production credit corporations in their credit, operation, and educational programs.

Review of the work of the production credit system, the details of which are mentioned later in this report, show that the farmers and stockmen have been successful in running their own short-term credit units. Since they started operation in late 1933 and early 1934 they have enjoyed a steady growth both in members and volume of business. They have been able to build up reserves, strengthen their financial position, increase the amount of capital owned by their members, and hold losses to a minimum.

However, the mere figures as to the number of members and the business transacted by production credit associations is not sufficient to give a true picture of their accomplishments. By setting up new short-term credit standards which progressive private lenders have come to recognize, production credit associations have been of definite assistance to large numbers of farmers who have not used their facilities. Many of these private lenders have found it necessary to reduce interest rates, adopt at least a modified form of budget loan—advancing the money as it is needed during the season and scheduling repayments at the time the products are sold—and they are giving greater attention to the individual farmer's business and his problems.

The existence of production credit associations has also made it possible for its members to carefully work out long-term plans for operating their farms with the assurance that they will be able to

borrow money to finance any sound operation because through their associations they have constant access to the funds of investment markets and therefore will not be affected by the fluctuations in the local supply and demand for credit. Available information also indicates that members of production credit associations generally are making substantial financial progress. Such progress makes it possible for tenants to save up funds to use as a down payment on a farm of their own. In the case of farmers who already own their farms, it makes possible needed improvements to land or buildings or the purchase of livestock, equipment, or land necessary to increase the efficiency of the farm business. Or in the case of those who already have efficient units, improvement in their financial condition makes it possible for them to reduce their mortgage and other debts.

At the time Congress provided the law under which farmers and stockmen might organize production credit associations it recognized that earlier attempts of farmers to operate their own short-term credit units were unsuccessful, in a good many instances, because of their inability to obtain adequate capital and because of inadequate supervision of their activities. Therefore, Congress provided a means for overcoming these weaknesses by the creation of the 12 production credit corporations to provide adequate capital and proper supervision for the local production credit associations. The success with which production credit associations have operated has proven the wisdom of Congress' foresight.

Production Credit Corporations

By the Farm Credit Act of 1933, Congress made available $120,000,000 to capitalize 12 production credit corporations—one in each farm credit district—whose functions are to organize, to partially capitalize, and to generally supervise the production credit associations, which are the direct lending institutions of the Production Credit System. No other funds have been appropriated to further finance in any way the production credit corporations or production credit associations.

The total amount of $120,000,000 has been used in capitalizing the 12 corporations, ranging in amounts from $8,500,000 for the Production Credit Corporation of New Orleans in the Fifth Farm Credit District, to $13,500,000 for the Production Credit Corporation of Columbia, S. C., in the Third Farm Credit District. There has been no impairment or loss in the $120,000,000 originally appropriated. The total capital stock of the corporations has been subscribed by the Governor of the Farm Credit Administration, and is held by him on behalf of the United States.

The law authorizes each production credit corporation to maintain the amount of class A stock of each association in its district at approximately 20 percent of the actual or expected volume of loans made by the associations. The Governor may authorize additional purchases by each corporation of class A stock in an association when conditions warrant, and the corporations may at any time require the associations to retire and cancel class A stock held by the corporations if in their judgment the associations have the necessary resources available.

On December 31, 1939, approximately 63 percent of the total paid-in capital of the production credit corporations was invested in association class A stock. The remaining corporation capital is invested in approved securities from which income is derived. In addition the corporations also will receive income from dividends on association capital stock held by them when paid. From these sources of income the corporations are required to pay operating expenses and restore any losses or impairment of capital. Any excess earnings must be devoted to the creation and maintenance of a surplus equal to at least 25 percent of the paid-in capital of the corporation, and thereafter to the retirement of corporation stock held by the Governor.

Most of the capital of the 12 corporations is used to partially capitalize the production credit associations in accordance with the credit needs of the districts, and the remainder is invested to provide income and to build required reserves in order to assure adequate supervision and assistance to the associations in rendering proper credit service to farmers and stockmen.

The supervision given the production credit associations by the corporations consists mainly of formulating and carrying out management regulations, credit policies, and accounting and office procedures, and assisting the associations in extending their credit facilities, in educating their members, and in training their officers and employees. Each production credit corporation also has given thorough study to the 1940 budget of each production credit association in its district for the purpose of eliminating unnecessary expenditures and reducing to a minimum the administrative costs of the credit service through the associations.

Each production credit corporation has a board of directors composed of seven members. These directors constitute what is known as the Farm Credit Board and also serve as directors for the Federal land bank, the Federal intermediate credit bank, and the bank for cooperatives of the district.

The board of directors selects the management of each corporation subject to the approval of the Governor of the Farm Credit Adminis-

tration. The business and affairs of each corporation are conducted under the supervision and control of its board of directors subject to the general supervision of the Governor.

A consolidated statement of condition of the 12 production credit corporations as of December 31, 1939, appears as table 25 of the appendix.

Production Credit Associations

A production credit association is a local cooperative organization of farmers and stockmen which operates under a Federal charter granted by the Governor of the Farm Credit Administration. Its members consist of farmers and stockmen who obtain their credit requirements from the association. These members elect from among their number a board of directors which controls the business and affairs of the association. The directors select an executive committee which consists of two members of the board and the secretary-treasurer of the association. The executive committee acts as a loan committee for the association. The secretary-treasurer is the active manager and is responsible for carrying out the policies and decisions of the board of directors and the executive committee. The organization, management, and conduct of the business of an association are prescribed by the Governor in its charter and bylaws, and in the rules and regulations issued by the production credit corporation.

Number of Associations

There were 528 associations in active operation on December 31, 1939, and 13 which were in the process of liquidation, 3 of which were placed in liquidation during the year 1939. These associations serve every rural county in the United States and Puerto Rico. Each association is allocated a territory that will be large enough to provide a volume of business sufficient to permit efficient operation and at the same time small enough to make it possible for it to render prompt and convenient service to its members. The territory served by each association usually varies from one to several counties, depending upon the production credit requirements of the area to be served. Thirteen associations serve specialized producers, such as large range livestock operators and fruit growers. Each of these embraces a wide territory, usually an entire State.

If it becomes evident that an association does not have and appears unlikely to develop a sufficient volume of business to permit it to operate within its income, it is either liquidated or consolidated with another association. If an association suffers losses to the extent that its capital is impaired and it appears unlikely that its future business will restore such impairment, the directors may voluntarily

place it in liquidation. The jurisdiction of the territory served by any association placed in liquidation is allocated to another association, thus providing all farmers and stockmen who have a sound basis for credit with continuous credit facilities.

Loans

The production credit associations were established to provide farmers and stockmen who have a sound basis for credit with short-term credit for all types of farm or ranch operations. The purposes for which loan funds may be used include the production, harvesting, and marketing of crops; the breeding, feeding, and fattening of livestock; poultry raising; repairs, alterations, or improvements to farm buildings; the refinancing of short-term indebtedness; or for other general agricultural purposes such as the purchase of livestock, seed, feed, fertilizer, spray material, farm machinery or supplies, or to hire farm labor.

In order to provide farmers and stockmen with a permanent and dependable source of credit the associations must constantly give careful consideration to those factors which contribute to sound lending. They fix their loan term so that the repayment dates will coincide with the periods in which the livestock or products financed are marketed. Collateral lending without regard to the borrower's operating expenses and other needs for credit has been replaced by the extension of credit determined primarily by an analysis of the farming business with careful consideration being given to the farmer's or stockman's actual credit needs and to his income from normal farm operations. In other words, credit is extended on the basis of the farmer's credit needs and his ability to repay from his farm income. Such a policy is not only safe from the standpoint of the association, but is the only policy that is sound from the standpoint of the farmer.

Lending on the basis of collateral without giving due consideration to the income available is not sound from the farmer's standpoint because he may have to sell machinery, equipment, or livestock that are necessary for him to run the farm in order to repay the loan. Unless a loan can be repaid from the sale of crops and livestock raised for market, it may leave the farmer-borrower in poorer position to make a living than he was before he borrowed.

Source of Loan Funds

The proceeds resulting from the sale of a production credit association's class A stock are not loaned but are invested in approved securities. The association does not lend Government money but obtains its loan funds by rediscounting the notes of its member-borrowers

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with the Federal intermediate credit bank of the district. The bank in turn sells debentures in the investment markets to insurance companies, banks, individuals, and corporations. These debentures are secured primarily by the credit instruments representing these loans, and are not guaranteed either as to principal or interest by the Federal Government. Thus the production credit system is designed to give farmers who will pool their credit requirements through their cooperative productive credit associations a dependable source of credit by providing access to the money markets of the country where funds may be obtained at rates comparable to those paid by other industries.

Size of Loans

A recent survey indicated that more than half of the loans made by production credit associations which matured during 1939 were for amounts less than $450. In two districts half the loans were for less than $250. Under the plan generally followed loans are disbursed on a budget basis as the members actually need the money and repayments representing the proceeds of farm products sold are often received before the loan is fully disbursed, at least in general agricultural and range areas. Accordingly, the maximum amount outstanding at any one time on many of the loans is considerably less than the total amount loaned.

The law prohibits an association from making a loan of less than $50, and also provides that no one borrower shall be indebted to an association at any time in an amount in excess of 20 percent of its paid-in capital and guaranty fund unless the loan is approved by the production credit corporation of the district; and no one shall be indebted to an association in an amount in excess of 50 percent of its paid-in capital and guaranty fund unless the loan is approved by the Production Credit Commissioner.

Budgeted Loans

Farmers usually arrange to have their loans disbursed on a budget plan fitted to the needs of their individual farm businesses. This procedure not only provides each member with funds as they are needed during the season but assures him of adequate credit to complete his production operations. It also allows him to repay his loan in an orderly manner as he sells the crops or livestock financed. It also reduces his interest cost to a minimum because interest is charged on each dollar only for the actual number of days he has the use of it.

Maturity

Loans are generally made to mature within 1 year, the maturity date being fixed at the time the livestock or crops financed are ex-

pected to be marketed. Thus credit for operating expenses is repaid from the current year's income, but part of the credit used for purposes other than recurring costs may be renewed for an additional period. Consequently, an association before approving a loan involving capital expenditures or the refinancing of short-term debts, ascertains that provision has been or can be made for cash operating and living expenses.

Interest Rate Reduced

During 1939 the interest bill of members of production credit associations was further reduced by approximately $800,000 a year. This was accomplished by the production credit associations reducing their interest rate from 5 to 4½ percent a year, effective on all money advanced on or after February 24. This reduction followed a similar one-half of 1 percent reduction of the discount rate of the Federal intermediate credit banks which, in turn, was made possible by the favorable conditions in the money markets and the continued successful operating results of the entire short-term credit system including the banks and the production credit associations. It was the third time interest rates had been lowered since the production credit associations were first organized and again demonstrates the ability of the system to reflect the interest rates prevailing in the investment markets.

The rate of interest charged by production credit associations depends upon the discount rate of the Federal intermediate credit banks. The discount rate is governed by the rate which the banks pay on their debentures. The present discount rate is 1½ percent a year. The rate at which each association may lend to its members is limited to a spread of not more than 3 percent above the discount rate. The funds derived from this 3-percent spread together with funds the association obtains from its invested capital are used to pay its operating expenses, cover any losses on loans, and to build necessary reserves. After the necessary reserves have been built, additional earnings may be used to pay dividends.

Only by having accurate knowledge of a farmer's operations can the loan committee decide whether the association can make him a loan and, if so, how to adapt it to his particular business. Therefore, a representative of the association visits the farm of each prospective member so he can give the loan committee a complete picture of the farmer's operations. The applicant pays the cost of the visit.

Members also pay for the cost of searching titles. Charges for recording or filing of mortgages and satisfaction of records are fixed by State law. The associations have cooperated with proper officials in having the recording and filing charges reduced in 38 States.

Every effort is being made to provide short-term credit for agriculture at the lowest cost possible consistent wth sound business practice.

Cash Loan Fund

Each production credit association has continued the use of its cash loan fund to expedite its lending functions. This fund is created by utilizing the cash on hand or by direct borrowing from the Federal intermediate credit bank of the district. Within prescribed limits an association may disburse loan proceeds from this fund upon approval of the loan by its loan committee without awaiting the forwarding of the member's note for discount to the Federal intermediate credit bank. This enables associations to make loans to its members in a few day's time. Notes offered to the credit bank which are not rediscounted by that institution and which cover loans already made by an association are carried by the association itself until placed in discountable condition or until they are collected.

On December 31, 1939, the total indebtedness of the production credit associations to the Federal intermediate credit banks for loans and discounts amounted to $144,983,174, of which $14,500,013 represented direct loans secured by bonds. The total rediscounts with the banks on December 31, 1939, represented 84.5 percent of the total balance of loans outstanding in the associations. The remaining 15.5 percent of loans outstanding not rediscounted were carried in the associations' cash loan funds.

Volume of Loans

During 1939 farmers obtained 234,266 loans, including renewals, for a total of $320,961,046, as compared with 243,484 loans for $302,622,809 during 1938. From their organization to December 31, 1939, farmers and stockmen have obtained 1,312,446 loans from the associations, amounting to $1,441,801,080. Practically all renewals are extensions of credit to finance range livestock, dairy, or general farming operations which because of their continuing nature ordinarily require credit for a longer period than that for which initial loans are made by the associations.

Because members are now generally budgeting their entire year's credit requirements and obtaining one loan which is paid out in several advances during the season whereas heretofore many members obtained their credit requirements in more than one loan during the year, there was an increase in the amount loaned in 1939 while there was a slight decrease in the number of loans.

The $187,843,965 outstanding in loans on July 31, 1939, represented the largest month-end balance thus far reported.

On December 31, 1939, farmers and stockmen had 156,884 loans outstanding for a total of $154,495,565, compared with $148,036,721 on the same date last year.

Table 27 of the appendix shows the number of applications received, loans closed during 1939, loans outstanding at the end of the year, and the median size loan in each State.

Table 28 of the appendix shows the number of applications received, loans closed, and loans outstanding for specified periods from organization to December 31, 1939.

Capital Stock

The capital stock of each production credit association is divided into two classes, A and B. Class A stock, which is nonvoting and preferred as to assets in case of liquidation, is held principally by the production credit corporation of the district in such amounts as the credit needs of the district require. Farmer-members who no longer have to borrow from the association may exchange their class B for class A stock which is also available for purchase by private investors.

The class B stock may be purchased only by member-borrowers and those eligible to become members. Each member of an association owns class B stock in an amount equal in fair book value (not to exceed par) to $5 for every $100, or fraction of $100, borrowed. Class B stock has the voting rights and each holder is entitled to only one vote regardless of the amount of stock held. In order to encourage attendance at annual meetings and prevent the control of an association falling into the hands of a small group of members, voting by proxy is prohibited. Class B stock, if not sold to another member of the association, must be converted into class A stock within 2 years after a stockholder ceases to be indebted to the association. This provision makes certain that control of all associations will rest in the hands of their active member-borrowers.

The par value less liquidating dividends not exceeding par of capital stock of all production credit associations on December 31, 1939, was $92,057,047, of which $16,119,137, or 17.5 percent, represented class B stock owned by 258,717 farmers and stockmen. On December 31, 1938, farmers and stockmen owned $14,998,202 of class B capital stock of their production credit associations, and on December 31, 1937, they owned $13,391,162 worth. The corporations' investment in the associations' class A stock on December 31, 1939, was $75,369,875.

Income and Expense

Total gross income of production credit associations for the year 1939 amounted to $13,349,351. Of this amount $9,942,487 repre-

sented operating income obtained from interest on loans, loan service fees, and miscellaneous income. The remaining $3,406,864 represented income from the investment of accumulated earnings and the funds obtained by the sale of class A and class B stock.

Interest expense amounted to $2,817,309 and operating expenses excluding charge-offs and provision for estimated losses, amounted to $6,523,796. Net earnings before consideration of losses charged off and provision for estimated losses amounted to $4,008,246. After consideration of charge-offs and estimated losses represented by valuation reserve adjustments of $773,795, net income for the year totaled $3,234,451. During the year 1939, 308 associations, compared with 283 associations in 1938, operated on income from sources other than the earnings resulting from the capital invested in them by the production credit corporations.

The total legal reserves of all active associations amounted to $14,695,911 on December 31, 1939, or 16.4 percent of their total capitalization. Provision for estimated losses on the same date amounted to $1,854,787. The cash advances by all associations from date of their organization to December 31, 1939, totaled $1,121,095,537, and the net charge-offs during the same period plus valuation reserves as of December 31, 1939, amounted to $4,341,114, or four-tenths of 1 percent of the total cash advanced.

Table 29 of the appendix shows by districts as of December 31, 1939, the total cash advanced since organization; the total valuation reserves; the net charge-offs; the percent that valuation reserves plus net charge-offs is of total cash advanced; the total loans outstanding; the total legal reserves and undivided profits; and the percent that total legal reserves and undivided profits are of total loans outstanding.

Table 31 of the appendix shows the combined statement of condition of the 528 associations in operation on December 31, 1939, and table 32 shows the combined statement of condition of the 13 associations in active liquidation.

Examinations

Federal examinations, supplemented by credit examinations made under the direct supervision of the production credit corporations, give a complete analysis of each association's operations during the year.

Federal examinations.—The law requires that each association be examined at least once a year. Each corporation and association is examined by an examiner designated by the Governor of the Farm Credit Administration. The scope of these examinations includes an audit of the associations' books and records and a check of their

procedure to ascertain whether they are in conformity with the prescribed rules and regulations for them.

Credit examinations.—A credit examination of each association is made annually to determine the quality of each outstanding loan; to carefully appraise the lending, loan supervision, and collection procedures; and to observe the ability and performance of all personnel handling the credit work. These credit examinations are made by experienced and specially trained credit men under the direction of the production credit corporations according to credit standards and procedures prescribed by the Production Credit Division in Washington.

The loans are classified according to their quality with recommendations for improving the status of each criticized loan. On doubtful loans a valuation reserve is recommended which will reduce to a collectible sum the amount at which such loans are carried as assets on the books of the association. In addition to being of assistance to the management of each association in effecting needed improvement in their lending operations, the facts assembled during the examination are very helpful to the production credit corporation in supervising the affairs of the association and in planning future employee training meetings. Periodically during the year the corporations check the progress being made by each association in putting into effect the recommendations contained in the examination report.

Management and Operation Studies

The production credit corporations, in cooperation with the production credit associations, have about completed their original management and operating studies in all the production credit associations. These studies, together with follow-up studies, result in a more efficient and convenient credit service to members through the elimination of duplicated effort, refinement of procedures, and better allocation of duties among the association personnel.

Field Offices

The territory served by each association usually includes several counties, and in order to make the association's services more readily available to its members, the associations follow the policy of maintaining representatives at various points in their territories. During 1939 this representation was in general expanded and improved.

Wherever practicable, the associations establish field offices at points in their outlying territory which provide, to a large degree, the same services as are provided by the association's central office. At the close of the year the associations were maintaining 248 field offices which were open for business at all times during the year. In addition

to these there were 294 field offices which were open part-time or at least during the peak loaning season.

Where the number of members served is not sufficient to justify the expense of a regular field office, the association, wherever practicable, establishes a local representative, who may have no office other than his home, but who provides many of the services ordinarily performed by a field office. On December 31, 1939, there were 672 such representatives.

In addition to these types of field representation the associations maintain other representatives in their outlying territory who perform only limited services for the association, but from whom members or prospective members may secure information about the association's credit services. At the end of the year there were 417 of this type who were primarily application takers, and 695 representatives who were primarily inspectors.

As the number of full-time and part-time field offices and representatives performing many of the services of a field office have been increased, there has been a corresponding reduction in the number of association representatives located in the field who render only limited services. This change in the type of field representation has resulted in the associations' furnishing a more satisfactory service to their members.

Membership Education

If members of production credit associations are to assume the necessary responsibilities in connection with membership, it is essential that they be thoroughly familiar with the associations' operations. Consequently at the annual meeting of each association detailed reports of the association's progress, the amount and sources of the association's income, and the detailed expenses of its business are presented.

At these meetings members also elect the directors from among their number and transact other business that is brought before the meeting. The directors select the secretary-treasurer of the association and other personnel. The loan committee of an association consists of two of the members of the board of directors and the secretary-treasurer of the association. This committee has full responsibility in making association loans.

In 1939, 148,892 persons attended the annual meetings, or an average attendance per meeting of 280. This compares with 142,609 persons during the preceding year with an average of 267 persons per meeting. Thirty percent of the members of production credit associa-

tions attended these meetings in 1939. This is the highest percentage that has attended in any year since the associations were organized.

In addition to their annual meetings, a number of associations held county and community meetings of members during the year to discuss association business. Not only were the members supplied with a printed annual report of their association, but most of the associations furnished them with a midyear progress letter. The production credit corporations continually assist the associations in the planning and development of their membership programs.

Credit Education for Young People

During the year production credit associations throughout the United States made loans to 572 Future Farmers of America chapters and 484 4–H Clubs for the purpose of educating these young people in the wise use of credit by financing their individual crop or livestock projects. Their instructors in vocational agriculture or their 4–H Club leaders usually acted as trustees.

These loans, totaling $584,470, assisted 8,392 youths to finance their projects. The educational value of this type of loan is increased when the groups select their own loan committees to act upon the loan applications of their fellow members.

Education of Directors

Educational work with the association boards of directors was carried on both in the group conferences and in individual contacts with association boards of directors made by officers and representatives of the production credit corporations. During the year, 86 group conferences attended by 2,677, or 84 percent of the directors and all the secretary-treasurers of production credit associations, were held throughout the country. These meetings give directors an opportunity to discuss their common problems and to aid them to more effectively discharge their responsibilities in connection with the associations' operations.

Employee Training Program

The training program launched during the year 1938 was continued by the production credit corporations during the year 1939. This program consists of four courses, one on the Farm Credit Administration and the Production Credit System, one on credit principles and the analysis of farm business, one on association operations and procedures, and another on membership education and public relations. The first course has been given in all the districts, and the second and

third courses in most of the districts, while the fourth course will be given later. These courses, conducted by the production credit corporations, are presented to the directors and secretary-treasurers of the production credit associations at their regular group conferences held during the summer months. The secretary-treasurers of the local associations then conduct similar courses for their employees. It is contemplated that the second and third courses will have been given to all the associations by the end of 1940.

A comprehensive training program for employees to supplement their regular work is regarded as the best method of developing the efficient and well-trained personnel, which is essential to the maintenance of a lending system which can continuously serve the credit needs of its farmer-members on a sound and understanding basis.

Decentralization

As a result of the increased experience of production credit associations and the training and educational work carried on by the production credit corporations, it was possible to further decentralize the operations of the system during the year. The rules and regulations under which production credit associations operate were revised during 1939 to give more authority to the local associations' own officials in the proper extension of sound production credit. Likewise, the association bylaws were revised to give them greater clarity and to give more freedom of action to the local officials who are responsible for the proper conduct of the affairs of the associations.

Federal Intermediate Credit Banks

Establishment of the 12 Federal intermediate credit banks in 1923 under title II of the Federal Farm Loan Act represented the first approach by the Federal Government, on a Nation-wide and permanent basis, to meet the long-recognized need of farmers and stockmen for a dependable source of short- and intermediate-term credit.

The banks were not empowered to make loans to individuals, and aside from the authority given them to make loans of certain kinds to farmers' cooperative associations, they were intended to serve largely as sources from which financing institutions of various types could obtain funds needed by them in their direct lending to farmers and stockmen. The plan of operation was such that institutions obtaining funds from the intermediate credit banks gained for themselves and their farmer-borrowers various advantages previously not generally available. These advantages included maturities suited to the needs

of agricultural and livestock operations; stability of credit supply; and interest rates consistent with those paid by industrial and other users of credit.

The loan funds of the credit banks, the sources of which are explained later, are used to discount or purchase notes given by farmers and stockmen to production credit associations, State and national banks, privately capitalized agricultural credit corporations, incorporated livestock loan companies, and similar organizations. Notes so discounted must bear the endorsement of the original lending institution. In addition, the credit banks may make loans to such institutions on the security of paper eligible for discount and to production credit associations and banks for cooperatives on the security of such collateral as may be approved by the Governor of the Farm Credit Administration.

In order to obtain the rediscounting or borrowing privilege, a financing institution must satisfy the intermediate credit bank with respect to various factors pertaining to its operations and bearing upon the value of its endorsement. In this connection, it is customary for an intermediate credit bank to require, except in the case of commercial banks, that a substantial portion of the capital of each institution be invested in highly rated, readily marketable securities. These securities then are pledged with the bank as general collateral or are held available for this purpose. Banking institutions also may be required to deposit additional acceptable collateral.

Although considerable use was made of the credit banks' discount facilities during the first 10 years of their operations, farmers and stockmen benefited only to the extent that financing institutions made use of such facilities. Consequently, it was not until 1934, with the establishment of the Nation-wide system of production credit associations, which obtain most of their lending funds from the intermediate credit banks, that the benefits of the system became generally available to farmers and stockmen having sound bases of credit.

The Federal intermediate credit banks may make loans to farmers' cooperative marketing, purchasing, and business service associations, and may discount loans made to such cooperatives when endorsed and offered for discount by the banks for cooperatives. However, the credit banks have withdrawn almost entirely from the field of direct lending to cooperative associations. Most of the loans to cooperative associations on the security of commodities now are made by the banks for cooperatives. The larger of such loans are offered by them to the intermediate credit banks for discount. The banks do not discount for the banks for cooperatives physical facility loans or those for operating capital purposes.

In rediscounting commodity loans a bank for cooperatives deals with the intermediate credit bank in its district. It is customary, however, for cooperative associations of national or broad regional scope to apply for their financing to the Central Bank for Cooperatives in Washington rather than to the district banks. Large commodity loans made by the Central Bank are offered to the Federal Intermediate Credit Bank of Baltimore for discount. When the amount involved, or other circumstances warrant, the Baltimore bank offers one or more of the other intermediate credit banks the right of participation in the loan.

Federal intermediate credit banks are not authorized to receive deposits or to otherwise conduct a general banking business.

Maturities of Loans Discounted

Maturities acceptable to the intermediate credit banks usually coincide with normal marketing or liquidating seasons in order that farmers and stockmen may have their obligations coming due when funds are available for their repayment. Ordinarily, the maturities of loans discounted range form 3 months to 1 year. Under the law they may not exceed 3 years.

Interest and Discount Rates

Each Federal intermediate credit bank is authorized, with the approval of the Intermediate Credit Commissioner, to establish from time to time rates of discount and interest which, except with the approval of the Governor of the Farm Credit Administration, may not exceed by more than 1 percent a year the rate borne by the last preceding issue of debentures issued by it or in which it participated. Under existing regulations a note is not eligible for discount, or as collateral for loans, if the rate of interest charged the farmer or stockman at the time the loan was made exceeded the discount rate prevailing at that time by more than 3 percent a year.

Since February 1939 the loan and discount rates of all the Federal intermediate credit banks have been at the all-time low of 1½ percent a year in the continental United States and 2 percent in Puerto Rico. These rates have enabled discounting and borrowing institutions to make loans to their farmer-borrowers at the lowest interest cost ever generally available to them for credit of this character. For nearly 5 years prior to the February reduction in the loan and discount rates, the banks had maintained rates of 2 percent in the continental United States and 2½ percent in Puerto Rico, a previous low since establishment of the banks.

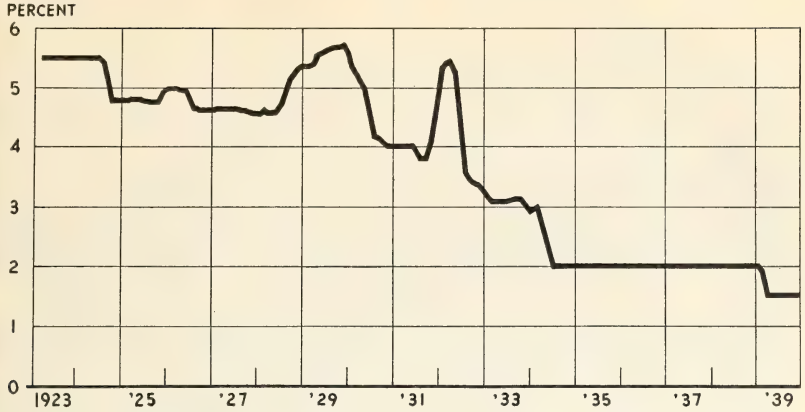


FIGURE 9.—INTEREST AND DISCOUNT RATES CHARGED BY FEDERAL INTERMEDIATE CREDIT BANKS

Volume of Business

During 1939 the Federal intermediate credit banks extended $471,935,618 of credit to financing institutions, banks for cooperatives, and cooperative associations, compared with $464,022,561 during 1938. Of the total volume of business in 1939, loans to and discounts for financing institutions amounted to $438,247,358, or 92.8 percent; loans aggregating $29,532,707, or 6.3 percent, were discounted for banks for cooperatives; and loans to cooperative associations totaled $4,155,553, or 0.9 percent.

Of the total volume of credit extended to financing institutions in 1939, $351,689,690, or 80.2 percent, represented loans to and discounts for production credit associations; and $86,557,668, or 19.8 percent, for privately capitalized institutions such as commercial banks, agricultural credit corporations, and livestock loan companies.

Loans to and discounts for production credit associations in 1939 totaled $351,689,690, compared with $331,752,701 in 1938, and $305,822,896 in 1937. During 1939 the Federal intermediate credit banks extended credit to one privately capitalized financing institution which had not previously obtained credit from them. On the other hand, eight corporations, owing to final liquidation of their lines of credit or for other reasons, ceased during the year to exercise their rediscounting privileges.

On December 31, 1939, outstanding loans and discounts of the Federal intermediate credit banks totaled $200,425,464, of which $180,679,672, or 90.1 percent, represented credit extended to financing institutions; $17,911,063, or 8.9 percent, discounts for the banks for

cooperatives; and $1,834,729, or 1.0 percent, consisted of loans to cooperative associations.

Of the amount outstanding for financing institutions, $147,325,258, or 81.5 percent, represented production credit association loans and discounts, and $33,354,414, or 18.5 percent, credit extended to other financing institutions.

Figure 10 shows the amount of loans and discounts of Federal intermediate credit banks outstanding during the years 1933 to 1939, inclusive, classified by the type of institution to which credit was extended.

Additional data relating to the volume of business handled during the year are given in tables 33 to 38 of the appendix.

Improvements in Procedure

Continued effective attention was given by the banks during 1939 to improving procedure. Although such improvements have resulted in further net reductions in cost of operations, maintenance of high operating standards as well as cost reduction is kept in mind in the consideration of possible improvements.

Debentures

Most of the funds used in the lending operations of the credit banks are derived from the sale of debentures to the investing public. To this end the banks are authorized, subject to the approval of the Farm Credit Administration, to issue and sell consolidated collateral trust debentures or other similar obligations having a maturity of not more than 5 years.

The debentures are instrumentalities of the Government of the United States. As such, they and the income derived therefrom are exempt from Federal, State, municipal, and local taxes, including surtaxes. However, the Government assumes no liability, direct or indirect, for such debentures.

The 12 institutions are jointly and severally liable, as to both principal and interest for consolidated debentures. Under the law the aggregate amount of outstanding debentures and other similar obligations issued by or on behalf of any Federal intermediate credit bank may not exceed 10 times the surplus and paid-in capital of such bank.

Debentures ordinarily are issued for terms of from 3 to 12 months, with interest payable at maturity. The par amount of debentures issued during 1939 was $282,900,000, of which $108,250,000, or 38.3 percent, carried maturities of 6 months or less and $174,650,000, or 61.7 percent, of more than 6 months. Of the total amount, 23 per-

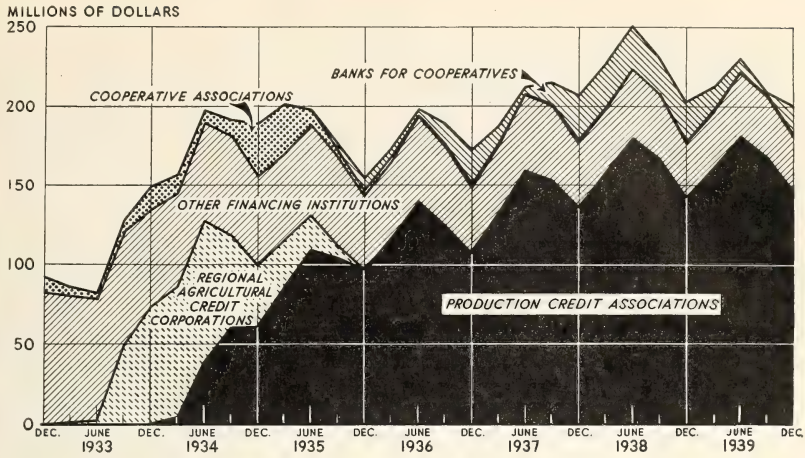


FIGURE 10.—LOANS AND DISCOUNTS OUTSTANDING FROM THE FEDERAL INTERMEDIATE CREDIT BANKS AT THE END OF EACH THREE MONTHS

cent was issued for 11½ months, this being the maximum maturity issued during the year. At the close of the year debentures outstanding aggregated $207,200,000 with maturities distributed over the ensuing 9 months. Further data relative to the amounts of debentures issued and outstanding are given in table 39 of the appendix.

Debentures usually are sold between the fifteenth and the twenty-fifth of each month for delivery on the first day of the succeeding month. Prior to November 1939, they were sold early in each month for delivery on the fifteenth. The change in sale and delivery dates was coincidental with a change in the maturity dates of debentures from the fifteenth to the first of the month. All debentures outstanding at the end of 1939 will mature on the first of the months in which they become payable. They are issued in denominations of $5,000, $10,000, $50,000, and $100,000.

Beginning in August 1939, debentures issued by the Federal intermediate credit banks have borne interest at the rate of three-fourths of 1 percent per annum. The previous face rate of 1 percent had been in effect since June 1938.

Debentures maturing in not more than 6 months are eligible for purchase by Federal Reserve banks and also may be accepted by them as collateral for 15-day loans to member banks under section 13 of the Federal Reserve Act. Debentures of all maturities are eligible as collateral for advances by Federal Reserve banks to member banks, under section 10 (b) of the Federal Reserve Act for periods not exceeding 4 months. Advances under section 10 (b) are made at a higher rate than those under section 13.

Federal intermediate credit bank debentures are lawful investments and may be accepted as security for all fiduciary, trust, and public funds held under the authority or control of officers of the United States. They are approved also as security for deposits of postal savings funds and are legal investments in various States, including the State of New York, for funds of savings banks, insurance companies, and for other fiduciary and trust funds.

With the approval of the Farm Credit Administration, Federal intermediate credit banks are authorized to rediscount eligible paper with Federal Reserve banks, and to sell paper in the open market with or without their endorsement. With like approval, a Federal intermediate credit bank may borrow from any available source, including the Reconstruction Finance Corporation, and may borrow from or rediscount paper with another intermediate credit bank or with any other banking institution. Interbank loans during 1939 aggregated $10,000,000, resulting in a saving of interest to the system as a whole through utilization of funds which otherwise might have been temporarily idle.

Franchise Taxes

The Farm Credit Act of 1937 provided that, subject only to review and approval by the Farm Credit Administration, each Federal intermediate credit bank, at the end of its fiscal year and after all necessary expenses and costs of operation for such fiscal year have been paid or provided for, shall apply its net earnings then remaining in the following manner: First, to making up any losses in excess of its reserve against unforseen losses and assets of doubtful value; second, to the elimination of any impairment of its paid-in capital and paid-in surplus; third, to the creation and maintenance of reserves against unforeseen losses and assets of doubtful value in such amount as its board of directors may prescribe; fourth, to the payment of 25 percent of the amount then remaining to the United States as a franchise tax; and fifth, to the transfer of the remaining net earnings into its surplus account. Franchise taxes paid to the Treasurer of the United States for the year ended December 31, 1939, aggregated $685,050.

Capital

During 1939 capital stock and paid-in surplus of the 12 Federal intermediate credit banks, all of which is owned by the United States Government, remained at $70,000,000 and $30,000,000, respectively.

Financial Condition and Earnings

Earned suplus of the banks was increased $2,055,150, after the payment of $685,050 as a franchise tax for 1939 and the addition of

$910,000 to reserve for contingencies. This compares with an increase in earned surplus of $2,944,230 for the year 1938, after payment of a franchise tax of $760,141 and an increase in reserve for contingencies of $690,000.

Full reserves are maintained against the asset value of furniture, equipment, automobiles, real estate acquired in the liquidation of paper, and similar items. Charge-offs and recoveries during 1939 resulted in net recoveries amounting to $15,432. In addition to amounts written off for established losses, fully adequate valuation reserves were maintained against possible losses in loans, discounts, notes receivable, and other assets. The net amount of losses charged off from organization in 1923 to date, including reserves for estimated losses, is twenty-two one-hundredths of 1 percent of the total volume of credit extended during this entire period.

The principal assets and liabilities of the banks, as of December 31, 1936, 1937, 1938, and 1939 are shown in the following condensed consolidated statement:

Asset and liability items of the Federal intermediate credit banks on Dec. 31, 1936, 1937, 1938, and 1939

ASSETS	Dec. 31, 1936	Dec. 31, 1937	Dec. 31, 1938	Dec. 31, 1939
Loans and discounts:				
Financing institutions (net)	$146,698,732	$175,802,596	$176,126,185	$180,152,678
Cooperative associations	1,640,765	1,813,471	920,126	1,834,729
Banks for cooperatives	22,313,575	29,154,555	25,283,884	17,911,063
Cash on hand and in banks	8,875,621	8,244,561	9,587,092	52,707,047
U. S. Government obligations, direct and fully guaranteed [1]	73,215,000	73,404,456	73,999,496	74,799,537
Other assets (net)	2,342,189	2,287,618	2,112,374	1,358,375
Total	255,085,882	290,707,257	288,029,157	328,763,429
LIABILITIES				
Unmatured debentures outstanding	$143,950,000	$174,950,000	$168,725,000	$207,200,000
Other liabilities	2,750,286	3,196,252	3,108,922	2,403,044
Capital stock paid in	70,000,000	70,000,000	70,000,000	70,000,000
Surplus paid in	30,000,000	30,000,000	30,000,000	30,000,000
Surplus earned	8,385,596	11,461,005	14,405,235	16,460,385
Reserve for contingencies		1,100,000	1,790,000	2,700,000
Total	255,085,882	290,707,257	288,029,157	328,763,429

[1] Carried at cost or par, whichever is lower.

A consolidated statement of condition and individual statements of the 12 Federal intermediate credit banks are given in tables 40 and 42 of the appendix.

Banks For Cooperatives

The 12 district banks for cooperatives and the Central Bank for Cooperatives, which were organized under the provisions of the Farm Credit Act of 1933, are designed to meet, on a sound business basis, the credit needs of farmers' cooperative associations that market farm products, purchase farm supplies for their members, or furnish farm business services.

Division of Lending Authority

For the most part, the credit needs of farmers' cooperative associations may be met by the district banks for cooperatives, one of which is located in each of the 12 farm credit districts. However, when the operations of an association are on a national or broad regional basis, thus extending over several farm credit districts, financing is generally obtained from the Central Bank for Cooperatives located in Washington, D. C.

In accordance with administrative policy, applications received by the district banks for amounts in excess of $500,000 are submitted to the Cooperative Bank Commissioner for prior approval. Unless the loan requested exceeds 10 percent of the district bank's combined capital and surplus, in the case of operating capital and facility loans, or 20 percent of its capital and surplus in the case of commodity loans, clearance is generally granted to the district bank to make the loan if such action is deemed administratively advisable by the bank's executive committee. However, whenever the loan, if made, would exceed these limits, a participation agreement is entered into with the Central Bank by the terms of which the two banks participate in the extension of credit. Under certain conditions the district banks are given an opportunity to participate in loans of the Central Bank, thus enabling the district banks to assist in the financing of large associations operating in the territory usually served by them. During 1939 the Central Bank participated in loans made by the district banks to seven associations and the district banks participated in loans made by the Central Bank to three associations. The banks for cooperatives are also authorized to make loans to each other, but during the year no such loans were made.

Capital

The Farm Credit Act of 1933 provides that the capital stock of the banks for cooperatives shall be in such amounts as the Governor of the Farm Credit Administration may determine are necessary to meet the credit needs of associations eligible to borrow from the banks. The Central Bank was originally capitalized at $50,000,000, while the

initial capital of each of the district banks was $5,000,000. From time to time the Governor has made additional subscriptions to the capital of each of the district banks and payments have been made for such stock from funds available in the revolving fund authorized by the Agricultural Marketing Act. During 1939, however, no changes were made in the United States Government's investment in the capital stock of any of the banks for cooperatives.

The law provides that each cooperative association receiving an operating capital or facility loan from the banks for cooperatives, at the time a loan is made, must own $100 of capital stock in the lending bank for every $2,000, or fraction of $2,000, it borrows. However, associations need own only $100 of stock for every $10,000, or fraction of $10,000, borrowed on security of approved commodities. Where the purchase of stock by cooperative associations is contrary to State law, the required amount may be paid into the guaranty fund of the bank. Upon full repayment of a loan, the borrower's capital interest may be retired at par, unless the stock of the bank has become impaired, in which case the stock is retired at par less its pro rata share of the impairment. Some borrowing associations retain their ownership of stock after their loans have been fully repaid. Thus, as of December 31, 1939, 77 former borrowers owned stock in the banks in the total amount of $50,100.

The capital of the banks as of December 31, 1939, is shown in the following table:

Capital of the banks for cooperatives paid in by U. S. Government and by borrowing associations, as of Dec. 31, 1939

Bank	Capital paid in by U. S. Government	Capital paid in by borrowing associations	Total paid-in capital
Springfield	$8,000,000	$216,900	$8,216,900
Baltimore	7,000,000	207,100	7,207,100
Columbia	6,500,000	154,300	6,654,300
Louisville	8,000,000	180,400	8,180,400
New Orleans	8,000,000	370,700	8,370,700
St. Louis	7,000,000	179,300	7,179,300
St. Paul	8,000,000	272,500	8,272,500
Omaha	7,000,000	152,400	7,152,400
Wichita	7,000,000	212,900	7,212,900
Houston	6,500,000	211,700	6,711,700
Berkeley	15,000,000	564,300	15,564,300
Spokane	11,000,000	329,400	11,329,400
Total	99,000,000	3,051,900	102,051,900
Central Bank	50,000,000	435,400	50,435,400
Grand total	149,000,000	3,487,300	152,487,300

Eligibility Requirements

To be eligible to borrow from a bank for cooperatives, a cooperative association must, as provided in the Farm Credit Act of 1933 as amended, be one in which farmers act together in:

1. Processing, preparing for market, handling, or marketing farm products;
2. Purchasing, testing, grading, processing, distributing, or furnishing farm supplies; or
3. Furnishing farm business services.

The act also stipulates that to be eligible an association—

1. Must be operated for the mutual benefit of its members;
2. Must not do business with nonmembers in an amount greater in value than its business with members; and
3. Must limit voting rights in the affairs of the association to one vote per member, or must limit dividends on stock or membership capital to 8 percent a year, or both.

In addition to these requirements at least 90 percent of the voting rights of an association must be vested in producers, except in the case of mutual fire-insurance cooperatives in which at least 75 percent of the voting media must be held by producers. An association, the membership of which is partly or wholly composed of other cooperative associations, is eligible to borrow only if each member association is so organized and operated as to be legally eligible to borrow in its own right.

Lending Policies

The banks for cooperatives are authorized by law to make loans only to cooperatives whose organization management and business policies are of such character as to insure the reasonable safety of the loan. Thus, before credit is extended a complete analysis is made of the various factors that tend to influence repayment ability. The outlook for agricultural production in the area served by an association, together with other factors that determine whether or not there is an economic need for the cooperative, is analyzed. The banks also inquire into the support given an applicant association by its farmer-members, and determine whether it has a sound capital structure and is operated in a businesslike manner.

In connection with their credit analyses of prospective borrowers, the banks for cooperatives require that reports on the associations' financial condition be prepared by an independent auditor and made available to the banks. Later, while they are indebted to the banks

for cooperatives, borrowers submit periodic reports on the results of their operations. During the past year several of the banks have made special efforts to raise the general standards of audits that are being made of cooperative businesses.

During the year each of the banks continued to stress the advantage of the revolving-capital plan, by which a small amount is retained out of the price of all commodities sold, or supplies purchased, through an association. Under the plan, evidence of the actual amounts so deducted for capital purposes are usually given to each producer at the end of each year in the form of capital stock certificates or similar evidences of capital interest in the association. When the cooperative has built up sufficient capital by this method, the current year's "retains" may be used to retire the oldest outstanding stock or other evidence of capital interest that had been issued to members. By continuing to operate on the revolving-capital plan the association is able to increase its capitalization as the need becomes apparent. In addition, each new member immediately begins to assist in capitalizing his association, while the capital interest of persons who cease to be producers is ultimately retired. Thus, control of the association is kept in the hands of active members who contribute to the association's capital structure in proportion to the volume of business they do through the association.

Types of Loans

Three distinct types of loans, commodity loans, operating capital loans, and facility loans, are made available to eligible cooperative associations by the banks for cooperatives.

Commodity loans, which are made on the security of staple farm products and supplies, are short-term loans, usually for the duration of the borrower's marketing or purchasing season. Loans on unhedged commodities may not total more than 75 percent of the current market value of the commodity pledged as security, while loans on hedged commodities may not exceed 90 percent of the commodity's value. A first lien on such products or supplies is taken as security.

By agreement with the Federal intermediate credit banks, the banks for cooperatives submit all commodity loans of $100,000 or more to the credit banks for rediscount. As of December 31, 1939, commodity loans of the banks for cooperatives totaled $20,949,650, of which $17,856,063 was under rediscount.

Operating capital loans are also made for short terms, primarily to supplement the borrower's working capital during seasons of peak activity. There are no statutory provisions regarding the type of

security required as collateral for operating capital loans. In general, liens on real estate, equipment, or inventories are considered acceptable.

Facility loans are made by the banks to enable borrowers to finance or refinance the acquisition of land, buildings, or other facilities. Security generally consists of a first lien on the property itself, although additional collateral is sometimes taken. Facility loans are limited by law to 60 percent of the fair appraised value of the security offered and may not be made for a term in excess of 20 years. In actual practice, however, most of the loans are scheduled for repayment within 10 years or less.

Interest Rates

The rates of interest charged by the banks for cooperatives are determined by the Governor of the Farm Credit Administration in accordance with statutory provisions and apply only to the unpaid principal portion of the loans. Effective February 24, 1939, the interest rates on operating capital and commodity loans were, respectively, reduced from 3 percent to 2½ percent and from 2 percent to 1½ percent, the new rates being applicable to loans made after that date. Interest rates on physical facility loans remained constant during the year at 4 percent. Loans made to cooperative associations in Puerto Rico bear interest at a rate one-half of 1 percent higher than the rates in effect in continental United States.

The trend of interest rates charged by the banks for cooperatives since their organization is shown in the following table:

Interest rates of the banks for cooperatives

Effective date	Interest rates applicable to loans made on or after the effective date indicated		
	Commodity loans	Operating capital loans	Facility loans
	Percent	*Percent*	*Percent*
June 16, 1933		4	4½
Mar. 16, 1934		3½	4½
May 16, 1934		3	4½
Apr. 10, 1935		3	4¼
June 3, 1935	2	3	4¼
June 24, 1935	2	3	4
Feb. 24, 1939	1½	2½	4

Volume of Business

During 1939 the 12 district banks for cooperatives and the Central Bank for Cooperatives made advances totaling $83,359,807, as compared to $94,945,530 in 1938 and $97,584,498 in 1937. Advances

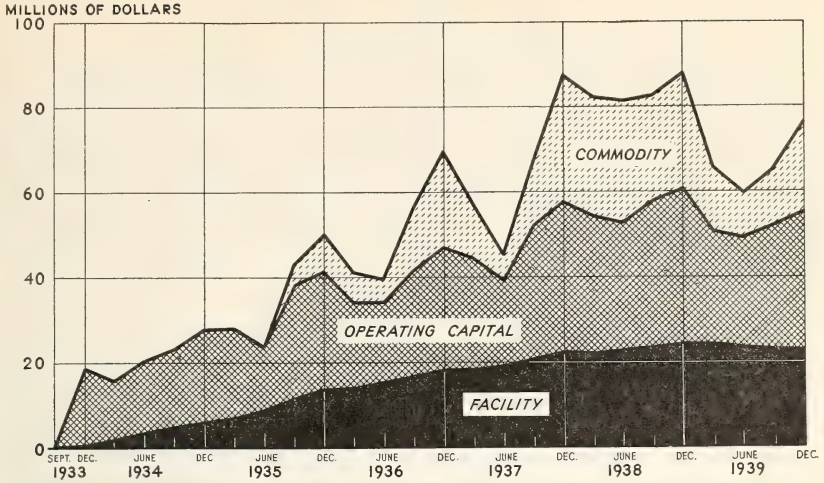


FIGURE 11. —LOANS OUTSTANDING FROM THE 13 BANKS FOR COOPERATIVES AT THE END OF EACH THREE-MONTH PERIOD

during the past year have increased the total loans made by the 13 banks since organization to $491,047,432, of which $413,724,871, or 84.3 percent, had been repaid as of December 31, 1939. At the close of 1939 the total loans outstanding of the 13 banks for cooperatives amounted to $76,252,342, as compared with $87,496,341 on December 31, 1938, and $87,633,166 on December 31, 1937. As of December 31, 1939, the banks had made loans to 2,436 cooperative associations of which 1,634 had loans outstanding on that date. The amount of loans outstanding, classified by type, from organization through December 31, 1939, is illustrated in figure 11.

The banks follow a conservative policy in connection with the establishment of reserves against loans where complete collection is regarded as doubtful. As of December 31, 1939, reserves against loans aggregated $3,870,620, or 5.1 percent of the amount of loans outstanding on that date. During the year loans amounting to $344,526 were transferred to liquidation accounts. Net losses in connection with assets acquired by the banks in liquidation of loans and charge-offs during the year totaled $210,001. The net earnings of the banks for the year 1939 amounted to $1,965,576, all of which was carried to surplus.

Additional financial and statistical information relative to the operations of the banks is presented in tables 44 to 49 of the appendix.

Stockholders' Meetings

The banks for cooperatives continued to hold stockholders' meetings to which were invited representatives of associations owning stock in the banks. In general, these meetings were also attended by representatives of nonstockholder associations and others interested in various phases of the cooperative movement. The programs were designed to enable both borrowers and nonborrowers to become more familiar with the operations of the banks and to afford an opportunity to discuss cooperative problems of general interest.

Administrative and Operating Developments

During 1939 a plan of internal organization based on a more precise functional assignment of duties to the principal officers was adopted by several of the district banks for cooperatives and a review and revision of the uniform accounting procedure of the district banks was made.

Federal Farm Mortgage Corporation

The Emergency Farm Mortgage Act of 1933 made available to the Land Bank Commissioner a fund of $200,000,000 to meet an urgent demand for additional and more liberal farm mortgage credit than could be provided by the existing permanent units of the farm credit system. The Federal Farm Mortgage Corporation Act, approved January 31, 1934, extended and broadened these emergency facilities and established the Federal Farm Mortgage Corporation. The unexpended portion of the $200,000,000 fund made available to the Commissioner by the Emergency Farm Mortgage Act and the mortgages and credit instruments previously acquired thereunder and the proceeds thereof were transferred to the Corporation for the purpose of subscription to its authorized capital of $200,000,000.

Organization and Management

The management of the Federal Farm Mortgage Corporation is vested by the Federal Farm Mortgage Corporation Act in a board of directors, consisting of the Governor of the Farm Credit Administration as chairman, the Secretary of the Treasury or an officer of the Treasury designated by him, and the Land Bank Commissioner. The board of directors may adopt such bylaws and regulations and appoint such officers and employees as it deems necessary to carry out the powers and responsibilities conferred upon the Corporation.

The executive committee of the Corporation, consisting of the president, the executive vice president, a vice president, the treasurer, and the secretary and assistant treasurer, administers the affairs of the Corporation when the board of directors is not in session. The officers of the Corporation are employees of the Farm Credit Administration and receive no additional compensation from the Corporation. The Corporation reimburses the Farm Credit Administration monthly for salaries and other expenses incurred and advanced on its behalf.

In addition to its Washington office staff, the Corporation has 1 or more vice presidents and, in several instances, 1 or more field representatives assigned to duty in each of the 12 farm credit districts. These district vice presidents and field representatives are also employees of the Farm Credit Administration and receive no additional compensation from the Corporation. The Corporation has designated in each district 2 officers or employees of the Federal land bank as district disbursing officers and 2 others as assistant secretaries. These bank employees receive no compensation from the Corporation. The Corporation, however, reimburses the Federal land banks for that portion of their time which is devoted to the affairs of the Corporation.

The Corporation may avail itself of the information, services, and facilities of any board, commission, independent establishment, or executive department of the Government with the consent of the governing authority of each such agency. The fiscal and financial services of the Treasury Department and the Federal Reserve banks are regularly utilized by the Corporation. The Federal land banks act as agents of the Land Bank Commissioner and of the Corporation, and their services, together with those of the national farm loan associations, are used extensively by the Corporation in the making and servicing of its loans and real estate. The Corporation compensates these institutions for services rendered on the basis of actual cost.

The utilization by the Corporation of the services of the Federal land banks and national farm loan associations in the making and servicing of its loans and in the servicing and selling of the Corporation's real estate has proved distinctly advantageous to the Corporation and Federal land banks and to their respective applicants and borrowers. Joint bank and Commissioner loans can be made and serviced through the same institution almost as a single loan transaction, thereby avoiding manifold duplications of effort and expense. Administrative decisions and actions required of the Corporation in the handling of distressed joint land bank and Commissioner loans,

which involve a conflict of interest between the bank and the Corporation, are made and authorized in the name of the Corporation by its district vice president rather than by the Federal land bank as its agent. The district operations of the Corporation and the manner in which they are handled by the bank as its agent are audited monthly by the district comptroller and semiannually by the Farm Credit examiners and their reports are reviewed by the Farm Credit Administration and the officers of the Corporation.

Bonds

The Federal Farm Mortgage Corporation is authorized, with the approval of the Secretary of the Treasury, to issue and have outstanding at any one time bonds in an amount not exceeding $2,000,000,000. The Corporation's bonds are lawful investments and may be accepted as security for all fiduciary, trust, and public funds, the investment or deposit of which is under the authority or control of the United States Government. They are fully and unconditionally guaranteed both as to principal and interest by the United States Government. They are issued in both registered and coupon form in denominations of $100 and up. Bonds may be exchanged for bonds of a different denomination of the same issue or coupon bonds may be exchanged for registered bonds of the same issue and vice versa by requesting local banks to effect the exchange through the Federal Reserve bank of the district. Transfer of registered bonds may be accomplished through the Federal Reserve banks in the same manner. Interest on registered bonds is paid by check on the United States Treasurer, mailed to the person who, 1 month before the payment date, is registered as the holder of the bond. The Division of Loans and Currency, Treasury Department, Washington, D. C., acts as transfer agent of the Federal Farm Mortgage Corporation and handles the details in connection with the issue, exchange, transfer, and maintenance of bond records. The Corporation's bonds can be purchased or sold through bond dealers and commercial banks. Commercial banks and local postmasters are accustomed to cashing matured interest coupons from coupon bonds.

Since its organization, the Federal Farm Mortgage Corporation has issued bonds aggregating $1,676,559,000, of which $1,279,387,900 were outstanding on December 31, 1939. As principal collections on Commissioner loans and short-term loans to Federal land banks continued substantially to exceed the demand for new Commissioner loans, the Corporation was able to reduce its outstanding bonds during the year by $108,372,000. Bonds retired during the year included

$8,350,000 purchased in the open market and two maturing issues aggregating $110,022,000. A portion of the funds used in the retirement of these maturing issues, however, was obtained by the sale of two new short-term issues of $15,000,000 and $10,000,000 each to the Secretary of the Treasury. The former issue was paid in full before the end of the year, leaving outstanding on December 31, 1939, the latter issue of $10,000,000, which will mature on September 1, 1940. This issue represents the only Corporation bonds maturing or callable during the year 1940.

Additional information on Federal Farm Mortgage Corporation bonds is contained in table 61 of the appendix.

Assistance to the Federal Land Banks

Approximately one-half of the bonds issued by the Federal Farm Mortgage Corporation has been for the purpose of furnishing the Federal land banks with funds for making land bank loans. At the time the Federal Farm Mortgage Corporation was created the demand for land bank loans was greater than the banks could readily finance through the issuance and sale of consolidated Federal farm loan bonds in the bond market. During the calendar years 1934 and 1935, the Corporation assisted the banks in financing their large volume of loan fund requirements by accepting their consolidated bonds in exchange for an equivalent amount of its own bonds. The fact that the Corporation's bonds are fully guaranteed both as to interest and principal by the United States Government gave them a wider market at lower rates of interest. In this way the Federal land banks were enabled to finance and make a large volume of land bank loans at interest rates considerably lower than they could otherwise have done. Since the beginning of 1936 the Federal land banks have sold their own bonds directly in the investment markets to obtain funds to make new loans as well as for refunding purposes.

During the years 1937 and 1938, the Corporation furnished the land banks with additional loan funds aggregating $47,700,000 through the purchase of their short-term notes secured by a like amount of consolidated farm loan bonds. The balance of these loans outstanding at January 1, 1939, was $26,200,000. The banks required no new loans from the Corporation during the year 1939, but instead were able to liquidate in full their short-term indebtedness to it. The loans made to each of the Federal land banks during 1937 and 1938, and the payments made thereon, are shown in the following table:

Loans made to Federal land banks during 1937 and 1938 and paid off prior to and during 1939

To Federal Land Bank of—	Amount loaned		Paid prior to 1939	Paid during 1939
	1937	1938		
Springfield	$1,000,000			$1,000,000
Baltimore	2,000,000		$2,000,000	
Columbia				
Louisville	3,500,000		3,500,000	
New Orleans	7,700,000	$600,000	5,700,000	2,600,000
St. Louis	4,000,000	3,100,000		7,100,000
St. Paul	2,800.000		2,800,000	
Omaha	13,500,000			13,500,000
Wichita	1,500,000		1,500,000	
Houston	4,000,000		4,000,000	
Berkeley				
Spokane	4,000,000		2,000,000	2,000,000
Total	44,000,000	3,700,000	21,500,000	26,200,000

Land Bank Commissioner Loans

Under the Emergency Farm Mortgage Act of 1933, as amended, the Land Bank Commissioner was authorized to make loans on behalf of the Federal Farm Mortgage Corporation until February 1, 1940.

Land Bank Commissioner loans may be made for the same general purposes as Federal land bank loans. They may be made upon the security of first and second mortgages on farm property, either real or personal, not exceeding, together with all prior encumbrances, 75 percent of the appraised normal value or "prudent investment value" of the property mortgaged. A loan may be made on the basis of "prudent investment value" where "the person occupying the property is not entirely dependent upon the income therefrom for his livelihood but receives a part of his income from other dependable sources." The maximum loan that may be made to any one farmer by the Land Bank Commissioner is $7,500.

Loans are payable on an amortization plan which stipulates a fixed number of annual or semiannual installments maturing within an agreed period of not more than 40 years from the date the first payment on principal is due. When, in the judgment of the Land Bank Commissioner, conditions justify it, provision may be made in the loan agreement requiring payments of interest only during the first 3 years the loan is in effect, if the borrower is not in default with respect to any other condition or covenant of his mortgage.

Loans by the Land Bank Commissioner are written to bear interest at the rate of 5 percent a year. The interest rate has been temporarily reduced by acts of Congress to 4 percent a year for all interest payments on installment dates occurring on or after July 22, 1937, and prior to July 1, 1940.

Most of the loans made by the Land Bank Commissioner represent either first mortgage loans on security not eligible for Federal land bank loans or second mortgage loans to supplement existing or new Federal land bank loans. Both Federal land bank first mortgage loans and Land Bank Commissioner first and second mortgage loans are made on the basis of joint applications to the Federal land banks and the Land Bank Commissioner, a single appraisal of the security offered, a single investigation of the credit standing and repayment ability of the applicant, and a single examination of the title to the security. This policy has avoided the confusion that would have resulted from requiring and reviewing separate applications for land bank and Commissioner loans and has materially reduced the cost per loan to the farmer, the bank, and the Corporation.

The availability of the supplemental lending facilities of the Corporation, where the amount loanable by the land banks within their limit of 50 percent of the value of the land and 20 percent on the value of the buildings to the farm is insufficient to meet the applicant's requirements, has enabled many thousands of deserving farmers to obtain additional funds sufficient to save their farms and to reestablish their operations on a more secure and businesslike basis, as well as assisted thousands of the country's best young farmers and tenants who had saved enough to make satisfactory down payments to purchase farms of their own.

During 1939, 16,423 farmers borrowed $27,417,350 from the Land Bank Commissioner, as compared to 17,453 farmers who borrowed $29,395,145 in 1938. From May 12, 1933, to December 31, 1939, the Land Bank Commissioner made loans to 536,075 farmers for $994,434,240. The number, amount, and percentage of loans of the various types made by the Federal land banks and the Land Bank Commissioner during 1939 are shown in the following table. Figure 12 shows the amount of money loaned each year and the amount outstanding at the end of the year.

Land bank and Commissioner loans made during 1939, by type of loan

Type of loan	Number	Percent of total	Amount	Percent of total
Federal land bank only	4,334	14.4	$14,813,800	18.8
Federal land bank closed jointly with Land Bank Commissioner	9,290	30.9	36,767,700	46.5
Land Bank Commissioner only, first mortgage	5,566	18.6	8,463,024	10.7
Land Bank Commissioner, second mortgage, not closed jointly with Federal land banks	1,567	5.2	2,496,870	3.2
Land Bank Commissioner, second mortgage, closed jointly with Federal land banks	9,290	30.9	16,457,456	20.8
Total	30,047	100.0	78,998,850	100.0

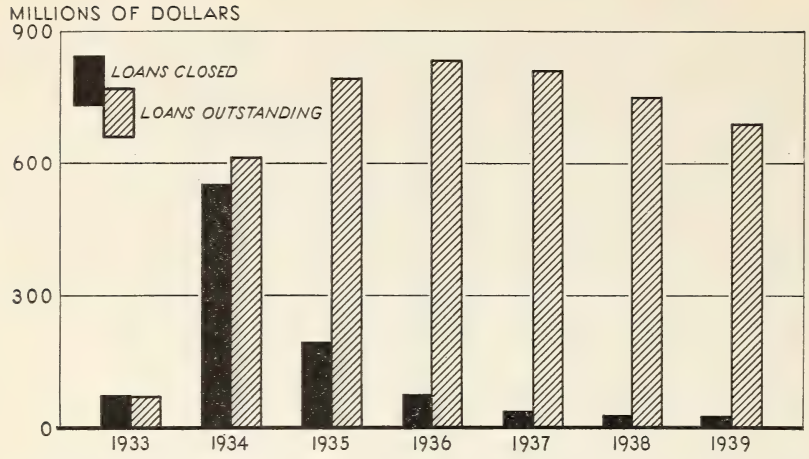


FIGURE 12.—LAND BANK COMMISSIONER LOANS MADE AND OUTSTANDING

The demand for new Commissioner loans was very heavy for the first 2 years after they were authorized, as evidenced by the $553,000,000 and the $196,000,000 farmers borrowed in 1934 and 1935, respectively. However, this was largely an emergency demand for the refinancing of distressed loans held by investors. During the past 3 years the amount farmers have borrowed from the Commissioner has been quite stable at the much lower figure of approximately $30,000,000 a year. The continuance of this demand is evidence of a basic and continuing need for assistance and credit of the type the Corporation can extend.

Further information on the number and amount of loans closed is contained in tables 50, 51, 52, and 53 of the appendix.

Loans Outstanding

On December 31, 1939, 439,076 loans were outstanding to farmers with an unpaid principal balance of $690,879,811, compared to 448,080 loans with an unpaid balance of $752,850,796 outstanding on December 31, 1938. This reduction in loans outstanding to farmers during the year 1939 was due to the fact that principal payments on loans and cancelations of loans by transfers to foreclosure or acceptance of voluntary deed exceeded the increases to the principal balance of loans outstanding arising from the closing of new loans and the inclusion of unpaid interest, extensions, and advances in the principal of reamortized loans.

Servicing of Loans

With the exception of a portion of its capital, all funds employed in making Commissioner loans have been obtained from the sale of

bonds of the Federal Farm Mortgage Corporation in the investment market. Because of the fixed requirements for payment of interest and principal on these bonds, the Corporation necessarily depends on a steady flow of collected funds to meet the debt service on its borrowed money, as well as its operating expenses.

The Federal Farm Mortgage Corporation attempts insofar as practicable to pursue a uniform policy of servicing its loans in all of the farm credit districts but necessarily varies its practices and procedures to meet the local conditions and circumstances in each of the districts. The Federal land banks determine the operating practices and procedures applicable to the Corporation's business in their respective districts subject to the approval of the officers and directors of the Corporation. This enables the Corporation to utilize to the fullest extent the services and skill of established district and local organizations with a background of long experience, intimate knowledge, and seasoned judgment in the farm mortgage field.

The servicing of Commissioner loans is carried on through the personnel and facilities of the 12 Federal land banks acting as agents of the Corporation, and approximately 3,700 national farm loan associations. Most of the direct contacts with borrowers are maintained through these local associations.

In approaching the collection problem, it has been the Corporation's policy to expect farmer-borrowers who have the ability to pay to do so according to the terms of their loans. In view of the conditions which gave rise to the making of Commissioner loans and continuing agricultural difficulties, particularly in certain distressed areas, the Corporation has endeavored to administer its collection policies with due regard to the ability of farmer-borrowers to pay, in the belief that a constructive policy of assisting farmers to remain on their farms would, in the long run, best accomplish the Corporation's aims.

While insisting that a borrower able to pay should do so, the Corporation has interpreted ability to pay as involving not alone the question of meeting currently maturing installments, but also his ability to maintain his farming business over a long term. It would obviously be unwise to insist on the last present dollar to apply on a current installment if such action would have the effect of impairing the borrower's ability to meet future payments. For the purpose of maintaining his existing schedule of payments, the borrower should not be forced into unsound farming practices such as mining his soil, or neglecting needed soil conservation practices, repairs, or replacements necessary for carrying on his operations. It should ordinarily be possible to rearrange his debt payments so that he need not sell off foundation livestock essential to well-balanced operation and continu-

ance of earning ability, or fail to provide necessary living expenses for his family. If an appropriate lengthening of the schedule of amortized payments is necessary to maintain a borrower's farming business as a going concern, the Corporation has willingly considered a suitable adjustment of the terms of payment.

When a loan installment becomes delinquent, the farmer is requested to call at the office of the local national farm loan association, through which his loan is serviced. His present situation and future prospects are discussed, and usually a definite program is agreed upon looking to a satisfactory plan for payment of the delinquent items.

If it appears that the borrower will be able to meet his delinquency in a short time either from the sale of crops or from some other source, the account is held in abeyance temporarily until the needed funds are in hand. A large percentage of loans are thus restored to a current status through simple forbearance for a limited period.

Where the financial condition and immediate prospects of the farmer-borrower indicate that more than temporary forbearance is needed, other methods are considered for disposing of the delinquent items. The circumstances of the farmer are considered in detail by the secretary-treasurer of the national farm loan association, and usually by the local board of directors of the association, and recommendations are made for the treatment of the delinquent account based on an intimate knowledge of farming conditions in the locality and of the borrower's ability to pay.

Each case is considered on its merits. An attempt is made to fit the type of aid extended to the needs of the individual farmer-borrower. To determine the worthy cases, the following personal test is applied. The borrower must (1) be doing his honest best; (2) be applying the proceeds of production above necessary living and operating expenses upon his primary obligations; (3) be taking proper care of the security; and (4) be able to carry a reasonable burden of debt under normal conditions.

Most frequently recommended is a formal extension of the delinquent amount for a definite time, usually until the end of the next harvesting period. Where conditions justify, the extension may carry over several years with a schedule of partial payments at regular intervals.

The deferment of principal installments may be arranged in cases where the regularity of farm income has been temporarily interrupted because of crop failures or other circumstances beyond the farmer's control. This may result in delinquencies which he cannot expect to make up within a reasonable time out of ordinary operations. In such cases, the principal portion of one or more installments may be

deferred to the end of the loan, but payments of interest will be required on the regular scheduled dates.

Most Commissioner loans were originally made payable in principal installments spread over a period of 10 years, following an initial period of 3 years during which no principal payments were required. While a substantial majority of Commissioner loan borrowers have been able to maintain their loans in current standing, a considerable number have found the recurring installments of principal too burdensome especially since such amounts have to be provided after the payment of taxes and in most cases after meeting installments of principal and interest on prior lien mortgages. Although the remedy of reamortization has been used in dealing with deserving cases since the authorization contained in the Farm Credit Act of 1937, a more active use of this remedy was brought about during the fall of 1939, with the result that up to the end of 1939, reamortization had been approved for approximately 70,000 borrowers on Land Bank Commissioner loans.

Farmers who can meet their present schedule of payments and still maintain a reasonable standard of living and follow sound farming practices are not encouraged to seek reamortization. However, all borrowers on 10-year Commissioner loans have generally been notified of the possibility of rearranging principal payments by reamortization, so that those who are now current in their loans may be informed of the availability of this remedy in case later events make such action advisable.

Beyond the reach of the ordinary types of forbearance, extension, or reamortization lies a range of delinquent cases needing special treatment and supervision in order to exhaust all reasonable means by which the borrower may be assisted in working out his indebtedness. The first of these special remedies is applicable where the Federal land bank holds a delinquent first mortgage and the Commissioner loan, also delinquent, is secured by a second mortgage on the same property. The installments on the latter may, where justified, be held in abeyance for a reasonable period in order to permit the borrower to bring up the delinquencies on his first mortgage and unpaid taxes to a current position. Payments on the second mortgage will then be resumed on a schedule reamortized to meet the borrower's situation.

A variable payment plan may be provided for the borrower in appropriate cases in areas subject to wide variations in farm income caused by fluctuating crop yields or prices for farm products. This plan is particularly adapted to areas where most of the income is derived from one or two crops. By this method, payments to be

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required on a Commissioner loan may be based on a share of the proceeds from crops produced, and thus be more definitely related to available income. This plan aims to assist the borrower to bridge over low-income years and recoup in years of better-than-average income. By means of a supplemental agreement, the Corporation may agree to extend for a definite period such parts of the regularly maturing installments as are not met from the crop share or variable contract as agreed on. The privilege of paying less than the scheduled installments in lean years, of course, entails the obligation to pay larger-than-ordinary amounts in good years. In that part of the cycle yielding less-than-average farm inome the borrower is naturally expected to cooperate by conducting his operations as economically as possible.

A suspended-payment plan is provided for use in proper cases in areas where present income from normal farm operations appears to be abnormally low with no immediate prospect for improvement. This plan would permit a predetermined reduction in the amount of regular installments over an agreed period, the remainder of the maturing amounts being extended until the end of that period. In such a case the borrower would agree that if he enjoyed unusual income during the life of the agreement he would apply a substantial portion of it to take care of the amounts previously extended.

An intelligent use of the various types of forbearance mentioned above should keep to a minimum the number of delinquent cases which must eventually go through to foreclosure. After utilizing the foregoing remedies to the fullest possible extent, however, it must be recognized that there will always be a small proportion of loans which, because of abandonment of the property, gross incompetency, bad faith, or other causes, must be disposed of through foreclosure or by the acceptance of a voluntary deed from the borrower, or by the transfer of the property and the related debt into stronger hands.

Collections

Prior to December 31, 1939, interest amounting to $185,173,880 had matured on Commissioner loans. As of December 31, 1939, farmers had paid 87.3 percent of this amount; 5.6 percent had been extended; 0.9 percent had been reamortized; 3.1 percent had been canceled by foreclosures or voluntary deeds; one-tenth of 1 percent had been charged off; and 3.0 percent was delinquent.

The 3-year deferment period expired prior to the beginning of the year 1939 on most of the Commissioner loans outstanding. Consequently, principal had matured prior to December 31, 1939 on most of the outstanding Commissioner loans, totaling $138,473,887, or 15.4

percent of their original face amounts. By December 31, 1939 farmers had paid $93,990,886, or 67.9 percent of these maturing installments; $15,980,622, or 11.5 percent, had been extended or deferred; $6,512,136, or 4.7 percent, had been reamortized; $4,125,462, or 3.0 percent, had been canceled by foreclosures or voluntary deeds; $107,119, or 0.1 percent, had been charged off; and $17,757,662, or 12.8 percent, was delinquent.

Farmer-borrowers had paid in full all matured installments on a total of 308,525 Commissioner loans as of December 31, 1939, as compared to 314,533 on December 31, 1938, and 350,139 on December 31, 1937. These loans in good standing on December 31, 1939, 1938, and 1937, were 70.3, 70.2, and 76.9 percent, respectively, of all loans outstanding. The classification and condition of loans outstanding as of December 31, 1939, is shown in the following table:

Classification of the number of Land Bank Commissioner mortgage loans outstanding, Dec. 31, 1939

Farm credit district	Total number of loans outstanding	Classified as not delinquent				Classified as delinquent (loans with matured installments unpaid and loans with delinquent extensions)	
		Loans with all matured installments paid in full		Loans with all matured unpaid installments extended with no delinquency in extensions			
		Number	Percent	Number	Percent	Number	Percent
Springfield	18,590	13,414	72.2			5,176	27.8
Baltimore	15,463	13,132	84.9	16	.1	2,315	15 0
Columbia	41,876	29,139	69.6	317	.7	12,420	29.7
Louisville	49,935	43,410	86.9	91	.2	6,434	12.9
New Orleans	26,463	14,837	56.1	330	1.2	11,296	42.7
St. Louis	36,466	31,938	87.6	340	.9	4,188	11.5
St. Paul	81,446	46,811	57.5	627	.8	34,008	41.7
Omaha	50,191	31,920	63.6	1,188	2.4	17,083	34.0
Wichita	41,138	24,768	60.2	279	.7	16,091	39.1
Houston	31,636	26,105	82.5	168	.5	5,363	17.0
Berkeley	24,544	17,515	71.4			7,029	28.6
Spokane	21,328	15,536	72.8	224	1.1	5,568	26.1
Total	439,076	308,525	70.3	3,580	.8	126,971	28.9

Temporary reduction in interest payable by Land Bank Commissioner borrowers was granted by acts of Congress amending section 32 of the Emergency Farm Mortgage Act of 1933. Under these amendments the rate of interest on Land Bank Commissioner loans may not exceed 4 percent a year for all interest payable on installment dates occurring in the period, commencing July 22, 1937, and ending June 30, 1940. An appropriation of $7,500,000 was made "to enable the Secretary of the Treasury to pay to the Federal Farm

Mortgage Corporation such amount as the Governor of the Farm Credit Administration certifies to the Secretary of the Treasury is equal to the amount by which interest payments on mortgages held by such Corporation have been reduced during the fiscal year 1938." A similar appropriation of $8,200,000 was made for the fiscal year 1939, and $7,425,000 for the fiscal year 1940. The amount of interest reduction granted to borrowers under this act prior to December 31, 1939, was $18,925,384. The distribution of the amount of such reduction granted during the calendar year 1939, by farm credit districts, is shown in table 57 of the appendix.

Additional data regarding collections and the condition of Commissioner loans are contained in tables 54 to 56 of the appendix.

Foreclosures

Each individual case in which foreclosure appears necessary is carefully investigated to determine whether further extension, forbearance, or other assistance offers any reasonable prospect of enabling the farmer-borrower to continue in the ownership and possession of his farm. In general the Corporation does not resort to the security to enforce payment of a Commissioner loan unless the borrower has become hopelessly delinquent, abandoned or failed to take proper care of the property, or shown evidence of bad faith in obtaining or carrying the loan.

During 1939 the Corporation increased its efforts to develop and apply to seriously delinquent loans every available form of forbearance, extension, reamortization, or other remedy which offered a reasonable prospect of avoiding foreclosure. Foreclosures during the last quarter of 1939 were limited to cases of an emergency nature such as those involving abandonment, bad faith, or actions to quiet title. This action was taken by both the Corporation and the Federal land banks to permit making a thorough study of conditions surrounding individual cases of foreclosure in an effort to determine whether additional means of assistance or a broader application of present policies might not be successfully employed to help deserving farmer-borrowers to resume the orderly liquidation of their loans. Many delinquent borrowers have had their loans placed in current condition by extension or reamortization under more favorable terms of payment. With improvement in agricultural conditions a substantial number of these borrowers will undoubtedly be able to resume the liquidation of their loans in a satisfactory manner.

The Corporation instituted foreclosure during 1939 on 3,467 first and 2,077 second mortgage Commissioner loans, as compared to 4,622 first and 2,945 second mortgage foreclosures during the previous year.

In the case of 5,166 joint land bank and Commissioner loans recommended for foreclosure, the Corporation determined that it had insufficient equities in the underlying security to justify protecting its investment, and the prior mortgage holders were permitted to proceed with the liquidation of their liens.

Real Estate

The number of farms and sheriffs' certificates owned by the Corporation increased during the year 1939 from 8,245 properties at the beginning of the year to 9,625 properties on December 31. The number of farms acquired during 1939 was 7,787, as compared to 6,638 and 4,421 during 1938 and 1937, respectively. The number of whole farms sold or redeemed during 1939 was 4,113, as compared to 2,249 in 1938 and 1,300 in 1937. During 1939 the Corporation abandoned 2,293 properties. These abandoned properties were acquired subject to Federal land bank prior liens and were deeded to the banks after determining that a worth-while equity for the Corporation no longer existed. Approximately 28.3 percent of the farms owned on December 31, 1939, were owned subject to Federal land bank prior liens.

Except in unusual cases, the Corporation does not retire the Federal land bank first mortgage loan when it forecloses its second mortgage and acquires the related security. It does, however, place the bank loan in good standing upon electing to protect its equity in the security and thereafter maintains it in current condition by paying current installments and taxes as they become due, unless and until it decides to abandon and deed the property to the bank. Such abandonments are due partly to decline in market values and partly to the accumulation of carrying costs, if the property is not quickly disposed of. The increase in investment arising from recurring installments on prior liens, plus necessary outlays for taxes, repairs, and servicing costs, frequently causes the Corporation to abandon cases where its equities already may be slender.

The Corporation follows the practice of expending a minimum amount of new funds for repairs and servicing on its farms and attempts to dispose of them as soon as possible after acquisition. It rents, preferably to prospective purchasers, most of those farms which it does not sell promptly after obtaining possession. Its sales are usually made on the basis of a 20-percent down payment with the balance payable under a sales contract or purchase-money mortgage. Purchasers of properties subject to prior liens usually assume the first mortgage loans.

In limited distressed areas, where the production of crops is highly speculative, the Corporation has made occasional sales of farms on a crop payment contract. This type of sale is made only where purchasers under the usual terms are not available and only to a purchaser who is a capable farmer in good standing in his community, has the necessary means and equipment to cultivate the property economically, makes a reasonable down payment, and agrees to pay subsequent taxes and to deliver to the seller an agreed proportion of the crop produced. In some other cases the Corporation may lease a farm with an option to purchase at the end of the lease period at the same price and under such terms as the Corporation would then be willing to sell the property. The lease provides for a minimum cash payment equal to 1 year's taxes on the property as a part of the agreed annual rental. On farms now held by the Corporation and available for sale, such a lease and option arrangement may be entered into with an acceptable former owner provided that, when he was a borrower, he did his honest best, took proper care of the property and applied the proceeds of production and other available income over and above necessary living expenses to the payment of his obligations and now has a reasonable prospect of being able to carry out the terms of his new undertaking.

Additional information on real estate acquired, sold, abandoned, and on hand, and on loans charged off, by districts, is given in tables 58, 59, and 60 of the appendix.

Financial Position

As of December 31, 1939, the total assets of the Federal Farm Mortgage Corporation, less valuation reserves, were $1,516,376,909. Its principal assets were consolidated Federal farm loan bonds, $761,129,840; mortgage loans, purchase money mortgages, and real estate sales contracts, $700,359,483; real estate and sheriffs' certificates, $11,254,007; and cash, $18,936,034. Its principal liability item was its Federal Farm Mortgage Corporation bonds outstanding in the amount of $1,279,387,900. The Corporation's statement of condition as of December 31, 1939, and its profit and loss statements for the years ended December 31, 1939, and December 31, 1938, are contained in tables 62 and 63 of the appendix.

The Federal Farm Mortgage Corporation has established valuation reserves for delinquent installments, extensions, loans in foreclosure, and real estate and chattels owned. A reserve is maintained for the full amount of delinquent interest installments and extensions, less any partial payments received. Reserves are also maintained on loans in suspense, loans called for foreclosure, sheriffs' certificates;

and real estate owned—if they are subject to prior liens—for the full amount of the Corporation's net investment in them. If the loans and properties are not subject to prior liens, the reserves maintained are for the difference between the Corporation's investment and their probable recovery or sale value. The reserve on chattels owned is for the full amount of the Corporation's investment. The total of these valuation reserves as of December 31, 1939, was $49,858,337.

The Corporation maintains no valuation reserve against the unpaid principal of its mortgage loans, purchase money mortgages, and real estate sales contracts. It is obviously impossible to make a reliable estimate of the ultimate losses which the Corporation may sustain in the final liquidation of these long-term loans which could be carried as a specific valuation reserve against these assets. However, the Corporation has transferred its net earnings since organization, after absorbing the operating deficit of $257,967 in connection with Commissioner loans made prior to the creation of the Corporation, to a surplus reserve for losses on mortgage loans. Any future earnings will continue to be transferred to this reserve until it amounts to 2½ percent of the unpaid principal balance of first mortgage loans and 10 percent of the unpaid principal balance of second mortgage loans, which would amount to $50,205,672 on the loans outstanding at December 31, 1939. The amount carried in this reserve on December 31, 1939, was $21,035,630, as compared to $27,758,264 at December 31, 1938, and $32,957,574 at December 31, 1937.

This reduction in the reserve for losses on mortgage loans was the result of capital losses sustained in connection with loans and real estate, and provision for anticipated losses through the adjustment of valuation reserves for distressed loans and real estate exceeding net operating profits.

Emergency Crop and Feed Loan Section

The Emergency Crop and Feed Loan Section is engaged in making loans, for short periods, to small farmers who cannot obtain loans from other sources for the production of crops or the feeding of livestock.

The loans are available to all farmers in the United States, Puerto Rico, and Hawaii who can meet the eligibility requirements.

Loans are made for the purpose of financing the fallowing of land, the production and harvesting of crops, and the purchase and production of feed for livestock. All loans are made on a secured basis. Loans for the production of cash crops are secured by a first lien on all crops financed with the loan proceeds, and loans for the purchase or production of feed for livestock are secured by a first lien on the

livestock to be fed. The maximum amount of each loan is limited to $400, and the interest rate is 4 percent per annum.

For the purpose of administering the loan program, 11 regional offices are maintained throughout the country, 8 of which are located in cities where other units of the Farm Credit Administration are located. The 11 offices are at Springfield, Mass.; Baltimore, Md.; Columbia, S. C.; Memphis, Tenn.; St. Louis, Mo.; St. Paul, Minn.; Omaha, Nebr.; Wichita, Kans.; Dallas, Tex.; Salt Lake City, Utah; and Spokane, Wash. Branch offices are also located in Puerto Rico and Hawaii under the supervision of the regional offices at Baltimore and Salt Lake City, respectively.

History of 1918–39 Loans

Beginning in 1918 and continuing at intervals until 1931, crop and feed loans were authorized in certain areas of the Nation for the purpose of meeting distressed farming conditions caused by flood or drought. However, because of the general prevalence of drought in 1931, combined with the national economic disaster, these loans were not confined in that year to isolated drought or storm-stricken areas but were made generally available in all sections of the country. They have continued to be made on a Nation-wide basis in each year since 1931.

As originally authorized, crop and feed loans were made available for the purpose of assisting farmers whose resources or ability to obtain financing had been seriously impaired or destroyed by the effect of drought or flood. In recent years, Congress has more specifically defined the scope of the loan program by limiting the maximum amount of loans to $400 and by providing that loans are not to be made to farmers who can obtain adequate financing through regular credit channels. In addition, the loan program has been coordinated with other Federal lending agencies in order that the loan applicant may be served by the agency which can best meet his needs and for the purpose of preventing different agencies of the Government from making similar loans to the same person during the same year.

In 1938 the basis on which these loans are to be made was further defined by Congress by a joint resolution, approved February 4, 1938, which provided that loans are to be made only to borrowers who, in the opinion of the Governor of the Farm Credit Administration, will undertake in good faith to repay their loans in accordance with the loan requirements.

Since the average emergency crop and feed loan borrower is a small farmer with limited resources who requires a crop production or a

livestock feed loan for a short period of time, any material reduction in crop yields or prices, or in the availability of other sources of credit, directly affects the economic position of the small farmer and his need for emergency crop and feed loan financing. This is illustrated by the following table showing the number of loans made each year during the period 1931–39:

Number of loans made, 1931–39

Year	Number	Year	Number
1931	438,756	1936	188,944
1932	507,631	1937	252,894
1933	633,586	1938	174,557
1934	445,189	1939	[1] 142,643
1935	424,441		

[1] Includes 1940 loans made in November and December 1939.

The above figures show that the number of loans made remained at a high figure during the 1931–35 period, when the general farm income was slowly rising from the low level which prevailed at the beginning of the period and when private credit was largely unavailable to the smaller farmers. On the other hand, with the increasing availability of short-term credit from private and cooperative sources, the number of loans has shown a gradual reduction during the last 5 years.

While the above table shows a general downward trend in the demand for emergency crop and feed loans during the past 5 years, this downward trend may be interrupted or even forced upward by the disturbance of any of the principal factors affecting the economic position of the small farmer, such as a drought throughout large sections of the country or a curtailment of private or cooperative credit. This is illustrated by the loan experience in 1937 when the loan volume showed an increase of 33.8 percent over the loan volume in 1936, the increase being due to the adverse effect of the 1936 drought on the limited resources of the small farmer, which greatly impaired his ability to obtain adequate crop financing and forced large numbers of such farmers to resort to the Emergency Crop and Feed Loan Section for assistance. However, with the return of more normal crop conditions in the drought-affected areas in 1937, there was a large reduction in the demand for loans in 1938 and a resumption of the general downward trend in loan volume.

The Authorization for 1939 Loans

From 1918 to 1937 the various loan authorizations made crop and feed loans available for only a limited period of time, generally for the calendar year in which the loan was authorized. In 1937, however, the act of Congress approved January 29, 1937, authorized the making of crop and feed loans on a continuing basis, and since that time loans have been made continuously, without interruption, from year to year.

For the purpose of making loans under the 1937 act, the First Deficiency Appropriation Act, approved February 9, 1937, appropriated the sum of $50,000,000 and provided that such funds should be available until June 30, 1938. In each following year, Congress has provided that the unexpended balance of this $50,000,000 appropriation, together with all collections made on 1937 and subsequent loans, should be available for making future loans. As a result of this policy, it was not necessary for Congress to appropriate any funds for the making of emergency crop and feed loans during the fiscal years 1938 and 1939. At the beginning of the fiscal year 1940, Congress supplemented the funds already authorized by an additional appropriation of $15,000,000, and present forecasts indicate that no further appropriation of funds will be needed for the fiscal year 1941.

The continuing authority to make loans from year to year has resulted in making the loans available to applicants, especially in the spring-crop areas, at a much earlier date than in former years. This has permitted a more careful consideration of the applicant and his needs and has enabled the farmer to plan his farming operations on a better basis because he knows, well in advance of the planting season, just how much money he will have available for the production of his crops.

Volume of Loans in 1939

The Emergency Crop and Feed Loan Section in 1939 made 142,643 loans to farmers amounting to $15,191,134. This was a decrease of 18.3 percent in the number of loans and 22.7 percent in dollar volume compared with 1938.

As in 1938, a study was made of the loan volume in 1939 for the purpose of obtaining information as to (1) the number of 1938 borrowers who did not apply for loans in 1939 and the source of credit or other means by which such borrowers were enabled to finance their farming operations in 1939, and (2) the number of new borrowers financed by the Emergency Crop and Feed Loan Section in 1939 and

the source of credit or other means by which such borrowers financed their farming operations or made a livelihood in 1938.

The results obtained from this study were substantially the same as those obtained in 1938, the statistics showing, in general, that a large percentage of farmer-borrowers who obtained loans in 1938 did not apply again for loans in 1939 and that, as a partial offset of this loss of former borrowers, a large number of new farmer-borrowers came to the Emergency Crop and Feed Loan Section in 1939 from other sources.

The 1939 study showed that 81,151, or 46 percent, of the farmers who obtained loans in 1938 did not apply for loans in 1939 and that, on the other hand, 52,948 new borrowers were added in 1939. While this indicates a decrease of 35,057 borrowers in 1939, the actual net decrease in borrowers was considerably less than this figure, inasmuch as the study indicates that 17,923 of the 1938 borrowers who did not again apply for a loan were persons who had discontinued farming operations in 1939, or had died, or whose whereabouts were unknown.

Of the 81,151 farmers who did not obtain further emergency crop financing in 1939, 29 percent were able to finance themselves, and 33 percent had sufficiently increased their credit standing to be eligible for loans from private and cooperative credit institutions. The study further indicated that less than 10 percent of the borrowers who did not return in 1939 were financed in that year by other governmental lending agencies.

The principal sources of credit or means of livelihood in 1939 of the 81,151 borrowers who obtained loans in 1938 but did not apply again for loans in 1939 is shown graphically in figure 13.

The 52,948 farmers who had not borrowed from the Emergency Crop and Feed Loan Section in 1938 but who did so in 1939 represented 38 percent of the farmers who obtained loans in 1939. The vast majority of these new borrowers were financed in 1938 by private and cooperative credit institutions or with their own resources,

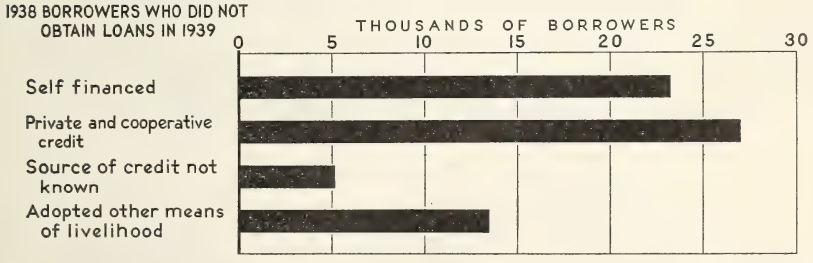


FIGURE 13.—1938 BORROWERS WHO DID NOT OBTAIN LOANS IN 1939

42 percent having been financed by private and cooperative credit and 43 percent having financed themselves. Less than 2 percent of these new borrowers were financed in 1938 by other governmental lending agencies.

The principal source of credit or means of livelihood in 1938 of the 52,948 new 1939 borrowers are shown graphically in figure 14.

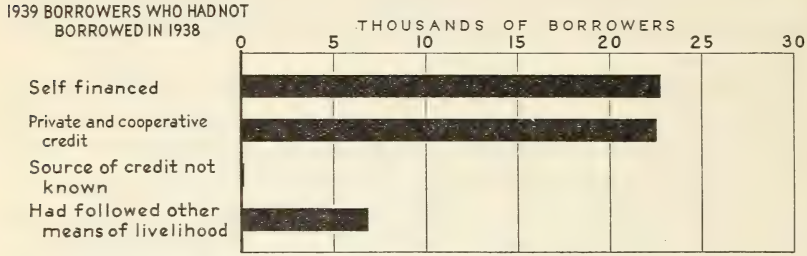


FIGURE 14.—1939 BORROWERS WHO HAD NOT BORROWED IN 1938

The results of this study indicate that a high percentage of those financed by the Emergency Crop and Feed Loan Section are small farmers who, although presently unable to obtain a loan from other sources, possess adequate farming equipment and workstock with which to farm and whose primary need is a loan for the production of crops or the feeding of livestock on a short-term basis. Consequently, any improvement in the economic position of this type of farmer during the year in which he is financed by the Emergency Crop and Feed Loan Section frequently means that, in the following year, he is able to finance his operations without further assistance from the Government.

On the other hand, the study indicates that the annual loss of former borrowers is offset each year, to a considerable degree, by a large number of new borrowers who find themselves unable to obtain loans from other sources and are forced to fall back on emergency crop and feed loans. This recurring number of new borrowers is primarily due to the fact that the resources of the average farmer financed by the Emergency Crop and Feed Loan Section are so limited that any unfavorable change in price or crop conditions frequently impairs his credit to such an extent that he is temporarily unable to finance himself or obtain financing from other sources.

Repayments on 1939 Loans

Of the $14,997,049 loaned on 1939 emergency crop and feed loans, $10,237,688, or 68.3 percent, had been repaid at the close of the year, as compared with 56.7 percent repaid on the 1938 loans at the end of 1938.

Of the 1939 loans which had matured by December 31, 1939, totaling $13,317,924, $10,207,915, or 76.6 percent, had been collected. The amount of money outstanding on 1939 loans at the close of the year was $4,759,361. Of this amount $1,253,189 represented winter wheat loans which will not mature until the summer of 1940.

Repayments on 1918–39 Loans

In authorizing emergency crop and feed loans in recent years, Congress has specifically indicated two types, namely, (1) loans for the production of cash crops secured by a first lien on the crops to be planted; and (2) loans for the purchase or production of feed for livestock secured by a first lien on the livestock to be fed.

The number of loans to farmers which are secured by liens on livestock, however, are relatively few. Of a total of 2,769,885 loans made since 1931, only 27,790, or 1 percent, were secured by liens on livestock. Thus, since practically all of the loans are secured only by a lien on the crop financed by the loan, repayments have been materially affected by crop yields and market prices. In sections where crops were good and a cash market available, repayments have been very satisfactory. In areas of partial or complete crop failure, they have fallen off materially.

The close relationship of repayments to crop yields and prices is illustrated by the 1939 experience in certain North Central States, which have been seriously affected by drought in recent years and where, primarily because of the effect of adverse weather conditions on crop yields, the repayment record has been considerably below normal. In 1939, however, due to a much improved crop and price situation, repayments in these States showed a very marked increase and compared favorably with repayment records in other States where crop conditions have been generally favorable in recent years.

Since liens given to secure crop-production loans are limited to the crops grown during the current crop season, the Government, with only a few exceptions, does not hold any existing security for unpaid crop loans made in prior years, although such loans are still evidenced as existing valid obligations by promissory notes. However, despite the unsecured character of these prior unpaid loans, substantial repayments on such loans continue to be made each year in areas where crop conditions are satisfactory, and these repayments are made even though the loans have been outstanding for a long period of time and past economic conditions have prevented borrowers from previously making any substantial payment on their loan obligations.

In collecting these unpaid prior loans, it is the policy of the Emergency Crop and Feed Loan Section to take into consideration the

financial condition of the farmer-borrower and to regulate the request for payment according to his ability to pay. Any attempt to obtain repayments on these loans by any means other than the usual collection measures is made only as a last resort and where the borrower has failed to act in good faith toward his loan obligation.

As an illustration of the active character of unpaid loans made in prior years, $5,968,455 was repaid in 1939 on loans made in 1938 and prior years, and more than $360,000 of this amount represented collections on loans made as far back as 1931 and prior years.

Over the entire period 1918–39, $375,899,651 has been loaned on emergency crop and feed loans. Of this amount $260,124,522, or 69.2 percent, has been repaid to date.

Unsecured Drought Loan 1934–35

In addition to secured crop and feed loans, the Emergency Crop and Feed Loan Section is charged with the administration of drought feed loans made by that Section in drought-stricken areas in 1934–35.

Loans made for this purpose were authorized by an act of Congress, approved June 19, 1934, which made available to the Governor of the Farm Credit Administration $96,785,000 for the purpose of making drought feed loans. Of this amount, $72,008,540 had been loaned when the appropriation expired June 30, 1935.

Collections on Drought Loans

Inasmuch as these drought feed loans were made solely on the basis of the borrower's promissory note, unsupported by any crop or livestock security, collections on these loans must necessarily come from livestock or crops of the borrower after liens on such livestock or crops have been satisfied. These liberal terms on which drought feed loans were made and the nature of such loans in the first instance have had a marked effect on repayments, although a steady and material liquidation of these loans continues to be made each year, $2,208,652 having been collected during 1939. As of December 31, 1939, $19,453,435, or 27 percent, of all drought feed loans had been collected.

Administrative Costs

The cost of administering the loan program in 1939, which included both the making and collecting of 142,643 current loans and the servicing of all unpaid prior loans, numbering 1,355,330, was $3,579,809, or an average of $2.39 for each loan.

Other financial and statistical data relative to the operation of the emergency crop and feed loan offices are found in tables 65 through 72 of the appendix.

Organizations in Liquidation

Up to this point this report has concerned itself with the permanent credit units operating under the Farm Credit Administration and with those of a temporary character, which, nevertheless, remain active in their particular field of rural credit. The following section is devoted to units which are in process of orderly liquidation.

Regional Agricultural Credit Corporations

The Emergency Relief and Construction Act of 1932 authorized the Reconstruction Finance Corporation to create in any of the 12 farm credit districts a regional agricultural credit corporation with a paid-in capital of not less than $3,000,000. Twelve corporations were created, one in each of the farm credit districts, to meet the farmers' and stockmen's existing needs for short-term credit.

The Executive order, effective May 27, 1933, transferred the supervision of the regional agricultural credit corporations to the Farm Credit Administration.

On May 1, 1934, the regional agricultural credit corporations were placed in orderly liquidation, inasmuch as the production credit associations, a permanent source of short-term credit, had recently been organized to provide farmers and stockmen with appropriate short-term credit facilities.

Progress in Liquidation

From organization, late in 1932, to the end of 1939, the regional agricultural credit corporations lent farmers and stockmen $327,989,140. This sum represents new credit extended and does not include renewals. On December 31, 1939, $8,004,748, or 2.4 percent of the total amount advanced, was outstanding. Repayments from organization to December 31, 1939, aggregated $317,228,853.

On May 1, 1934, outstanding loans totaled $144,671,174. On December 31, 1939, outstanding loans amounted to $8,004,748, representing a reduction of $136,666,426, or 94.5 percent.

During the year 1939 the number of loans outstanding in all regional agricultural credit corporations was reduced 28.8 percent, the amount outstanding was reduced 27.8 percent, and the average monthly operating expense was reduced 34.6 percent.

The total amount of the original paid-in capital of the corporations was $44,500,000. As a result of liquidation, repayments of capital have totaled $10,000,000 in 1935, $19,500,000 in 1936, $7,500,000 in 1937, and $2,500,000 in 1938. The present capital is $5,000,000.

The capital stock of existing corporations, as of December 31, 1939, is as follows:

Regional Agricultural Credit Corporation of—	Paid-in capital on Dec. 31, 1939
Washington, D. C.	$300,000
Minneapolis, Minn.	3,900,000
Sioux City, Iowa	200,000
Wichita, Kans., at Denver, Colo.	200,000
Salt Lake City, Utah	400,000
Total	5,000,000

During the period of liquidation the regional agricultural credit corporations have supplied additional credit to borrowers who have operated in good faith but who, for various valid reasons, have been unable to repay or transfer their indebtedness to permanent lending institutions. The bulk of new loans has been made to the western livestock men in the areas which were severely affected by drought during the years 1934 and 1936. New advances, from May 1, 1934, to December 31, 1939, have totaled $66,988,908.

In the process of liquidation it has been necessary for the corporations to acquire title to some of the collateral pledged for loans. From organization to December 31, 1939, the corporations have acquired title to property in the amount of $719,310, of which they have disposed of all except $218,149.

As is to be expected in the operation of lending organizations, especially those of an emergency character, some loans result in losses. When present sources of liquidation of such loans have been exhausted, a charge-off of the remaining balance is in order. The acquirement of title to property through the usual channels and its subsequent sale often results in losses. The total losses from all sources from organization to December 31, 1939, approximate $2,360,000, or seven-tenths of 1 percent of the amount loaned.

Outstanding loans of the regional agricultural credit corporations are appraised and classified periodically and reserves for estimated losses are established in all corporations. As of December 31, 1939, the reserves for losses on loans amounted to $2,549,863.

Reduction of Offices and Personnel

In the progress of liquidation mergers and consolidations of offices and corporations have been effected. At the time the regional agricultural credit corporations were placed in liquidation there were 12

principal offices and 21 branches. There are now in operation 5 corporations and 2 temporary suboffices.

As liquidation progressed, a corresponding reduction in personnel has been effected. On December 31, 1934, the corporations had 1,415 full-time employees and 935 per diem inspectors. On December 31, 1939, the corporations had 120 full-time employees and 90 per diem inspectors.

In reducing the personnel, an effort has been made to assist worthy employees in obtaining positions elsewhere.

Agricultural Credit Corporations Stock Purchase Loans

Prior to the establishment of the Farm Credit Administration the Secretary of Agriculture was authorized by an act of February 14, 1931, to make loans to individuals for the purpose of assisting them to purchase stock in existing agricultural credit corporations and to assist in the formation of new corporations which would be qualified to rediscount borrowers' notes with the Federal intermediate credit banks. This act appropriated the sum of $20,000,000 to be used in part for this purpose. A second act, approved March 3, 1932, provided for the establishment of a $10,000,000 revolving fund for the same purpose.

From these two appropriations loans were made to 967 individuals for a total amount of $1,513,024, proceeds of which were used to provide a portion of the paid-in capital of 54 agricultural credit corporations and livestock loan companies.

The administration of these loans, pursuant to Executive order No. 6084, effective May 27, 1933, was transferred from the Secretary of Agriculture to the Governor of the Farm Credit Administration. No loans were made subsequent to this transfer. On the date of transfer, 856 loans, totaling $1,442,444, were outstanding. Of the total loans made, 492, aggregating $1,027,429, have been repaid in full. Other loans have been partially collected, bringing the total of collections on December 31, 1939 to $1,073,912. There remain unpaid 475 loans, totaling $439,112. Liquidation of loans outstanding is being carried on as rapidly as practicable.

Agricultural Marketing Act Revolving Fund

The Agricultural Marketing Act, approved June 15, 1929, created a Federal Farm Board and authorized an appropriation of $500,000,000 to be used as a revolving fund to carry out the provisions of the act in promoting the effective merchandising of agricultural commodities and to place agriculture on a basis of economic equality with other industries. The Federal Farm Board administered this fund until

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May 27, 1933, when, by Executive order, the Farm Credit Administration became the successor of the Federal Farm Board and was given the administration of the remaining balance of the Agricultural Marketing Act revolving fund and the outstanding loans made from that fund to farmers' cooperative associations and stabilization corporations. Active lending operations from this fund were curtailed after the establishment of the Central Bank for Cooperatives and the 12 district banks for cooperatives created under the Farm Credit Act of 1933. A number of loans representing indebtedness to the fund are still outstanding, some of which are not yet due. These loans, together with acquired assets of the fund, are being liquidated in an orderly manner.

Progress in Liquidation

During the year 1939 outstanding loans were reduced in the total amount of $5,189,761, of which $5,189,412 represented cash repayments. Advances from the fund to cooperative associations amounted to $1,213,800, making a net reduction during the year of $3,975,961. Foreclosures have been resorted to only when the borrowers have consented; when they have not made reasonable efforts to meet their obligations or have abandoned the mortgaged properties; or when other conditions made it necessary to take such action for the protection of the best interests of the Government.

In keeping with the program of orderly liquidation of the revolving fund, a number of properties consisting largely of grain elevators, grain warehouses, and related machinery and equipment which were acquired by assignment or foreclosure are being sold in accordance with good business practices and Government regulations.

The Grain Stabilization Corporation and the Cotton Stabilization Corporation, which were established under the Agricultural Marketing Act, have been dissolved. Some claims and receivables of these corporations which were assigned to the revolving fund still remain to be liquidated, including notes representing an indebtedness on the part of the German Government for the purchase of wheat from the Grain Stabilization Corporation during the latter part of 1931 and early 1932. These notes were assigned to the Federal Farm Board as security for loans made to the Grain Stabilization Corporation from the revolving fund. As of December 31, 1939, the balance due on the notes of the German Government amounted to $1,346,610.

The Farmers National Grain Corporation, which was organized in 1929 by various grain cooperatives as a national grain sales agency, and which was financed in part by loans from the revolving fund, is now winding up its affairs through voluntary liquidation.

Subscription to Stock in Banks for Cooperatives

The Farm Credit Act of 1933, under which the Central Bank for Cooperatives and the 12 district banks for cooperatives were established, provided for the payment from the revolving fund of the capital stock of these institutions by the Governor of the Farm Credit Administration. Net disbursements from the revolving fund for this purpose aggregate $149,000,000, of which $50,000,000 represents the purchase of stock in the Central Bank for Cooperatives and $99,000,000 represents the purchase of stock in the 12 district banks for cooperatives. There were no additional disbursements for this purpose during 1939.

Loans Outstanding

On December 31, 1939, loans from the revolving fund in the sum of $87,207,043 remained outstanding, as compared with $466,242,668 outstanding on May 27, 1933, when, by Executive order, the Farm Credit Administration succeeded to the functions of the Federal Farm Board. Of the amount of loans outstanding on December 31, 1939, $66,659,612 represented loans to the Grain Stabilization Corporation, which is now dissolved, against which a reserve of $65,300,000 has been established. Loans to cooperative associations outstanding on December 31, 1939, amounted to $20,547,430. This included $15,523,386 in merchandising loans and $5,024,044 in facility loans.

Additional data regarding operations and a statement of condition of the revolving fund are given in the appendix tables 77 to 79.

Joint Stock Land Banks

The organization of joint stock land banks was authorized under the provisions of the Federal Farm Loan Act, approved July 17, 1916. The banks are privately capitalized institutions and were granted power to make long-term amortized loans secured by first mortgages on farm real estate from funds obtained primarily from the sale of tax-exempt bonds to the investing public. The Farm Credit Administration, as successor to the Federal Farm Loan Board, exercises general supervisory authority over them and directs their liquidation in cases of receiverships.

From April 24, 1917, to July 1, 1931, 88 charters were issued to joint stock land banks by the Federal Farm Loan Board. By May 12, 1933, this number had been reduced to 50 as a result of mergers and liquidations. Of this number, 3 were in receivership and 47 were being operated under their own management.

Under the provisions of the Emergency Farm Mortgage Act of 1933, no bank was permitted to issue tax-exempt bonds or to make any farm loans after May 12 of that year except as they were necessary and

incidental to the financing of existing loans or bond issues or to the sale of any real estate owned or acquired by the banks.

As of December 31, 1939, 35 banks were liquidating their assets and retiring their obligations in accordance with the requirements of the Emergency Farm Mortgage Act of 1933, and 6 banks were in receivership. Of the former, 3 banks were operating under plans of voluntary liquidation adopted pursuant to the provisions of sections 16 and 29 of the Federal Farm Loan Act. During the year, 3 banks completed their liquidation.

Progress in Liquidation

The progress made in liquidating the banks not in receivership on December 31, 1939, is summarized in the following table:

Reduction in gross assets and secured liabilities, from May 1, 1933, through Dec. 31, 1939

Period	Gross assets		Bonds and notes payable	
	Amount of reduction	Percent of amount on May 1, 1933	Amount of reduction	Percent of amount on May 1, 1933
May 1 to Dec. 31, 1933	$28,191,664	5.8	$36,005,393	8.7
1934	110,044,458	22.6	103,037,063	24.8
1935	73,745,387	15.1	66,167,450	16.0
1936	37,243,584	7.7	35,280,203	8.5
1937	42,002,968	8.6	34,056,815	8.2
1938	26,241,560	5.4	20,668,844	5.0
1939	19,366,451	4.0	15,184,154	3.6
Total reduction	336,836,072	69.2	310,399,922	74.8
Amount remaining Dec. 31, 1939	150,182,564	30.8	104,481,762	25.2
Total on May 1, 1933	487,018,636	100.0	414,881,684	100.0

The table above indicates that the amount of liquidation has been diminishing during recent years. The relationship between the reduction in gross assets and the reduction in bonds and notes payable, however, has grown increasingly less favorable. This is due primarily to the reduction in the amount of loans refinanced by the Federal land banks and the Land Bank Commissioner and the decrease in the amount of discounts which the banks were able to obtain in the purchase of their bonds. This less favorable relationship in 1939, as in 1938, resulted principally from the payment of dividends including final liquidating dividends for three banks, with of course no corresponding reduction in bonds or notes payable.

While the decrease in total assets for all banks from May 1, 1933, through December 31, 1939, amounts to 69.2 percent, there have been wide variations in the extent of liquidation among the indi-

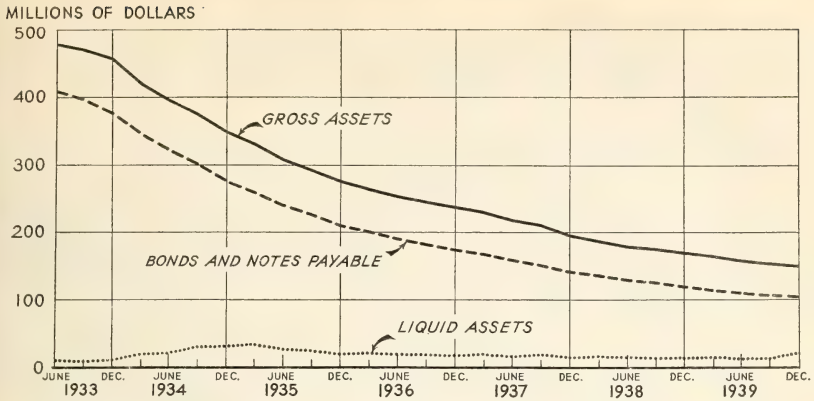


FIGURE 15.—PROGRESS IN LIQUIDATING JOINT STOCK LAND BANKS

vidual banks. Of the 47 banks, 4 have liquidated less than 50 percent of their assets since May 1, 1933; 21 have liquidated from 50 to 75 percent; 10 have liquidated from 75 to 99.9 percent; 3 were placed in receivership; and the remaining 9 banks have completed liquidation and surrendered their charters. The banks in the latter category are the Mississippi Joint Stock Land Bank of Memphis, Tenn., which was merged with the Tennessee Joint Stock Land Bank of Memphis on February 28, 1934; the Corn Belt Joint Stock Land Bank of Taylorville, Ill., which was dissolved on May 25, 1934; the Tennessee Joint Stock Land Bank of Memphis which was dissolved on December 13, 1937; the Pacific Coast Joint Stock Land Bank of San Francisco which was dissolved on August 24, 1938; the Union Joint Stock Land Bank of Louisville which was dissolved on June 21, 1938; the Maryland-Virginia Joint Stock Land Bank of Baltimore which was dissolved on June 23, 1938; the California Joint Stock Land Bank of San Francisco which was dissolved on July 24, 1939; the Greenbrier Joint Stock Land Bank of Charleston, W. Va., which was dissolved on March 17, 1939; and the Greensboro Joint Stock Land Bank of Raleigh, N. C., whose final liquidating dividend was approved on March 18, 1939, but due to litigation the charter has not yet been canceled.

The Mississippi bank was liquidated through merger with the Tennessee bank, which acquired its assets and assumed its liabilities. In each of the other instances the plan for voluntary liquidation authorized by the banks' stockholders made satisfactory provision for meeting the banks' obligations and was approved by the Farm Credit Administration. Cash was deposited in the United States Treasury to cover unpaid bond obligations, including interest, and

when necessary additional funds were placed in escrow in order to meet other miscellaneous obligations of the banks. Final liquidating dividends were paid with the approval of the Farm Credit Administration.

While in 1933, 1934, and the early part of 1935 a large volume of joint stock land bank loans were refinanced by the Federal land banks and the Land Bank Commissioner, in more recent years there have been fewer loans eligible for refinancing by them. As a result, the principal sources of mortgage loan refinancing since 1937 were insurance companies and other lenders.

The investment in loans refinanced by Federal land banks or the Land Bank Commissioner and by other lenders, together with the percentage of recovery, is shown by years in the following table:

Investment in and recovery on loans refinanced May 1, 1933–Dec. 31, 1939

Period	Loans refinanced by Federal land banks or Land Bank Commissioner		Loans refinanced by other lenders	
	Investment	Percent of investment recovered	Investment	Percent of investment recovered
May 1 to Dec. 31, 1933	$9,198,904	92.5	$5,576,596	83.5
1934	90,972,005	91.9	2,556,569	89.0
1935	31,763,724	89.3	8,516,760	97.8
1936	7,908,117	96.9	8,321,078	97.1
1937	3,101,149	97.0	7,650,806	99.1
1938	1,497,013	98.9	3,979,517	99.7
1939	1,309,197	97.2	9,477,914	99.9
Total	145,750,109	91.9	46,079,240	96.3

Since May 1, 1933, 83.7 percent of total mortgage loans outstanding has been liquidated. Of the total amount liquidated, 61.4 percent represented loans sold or paid in full by borrowers, 9.8 percent represented amortization and special payments by borrowers, foreclosures and voluntary deeds accounted for 26.7 percent, while the remaining 2.1 percent was made up of charge-offs and miscellaneous adjustments. Since May 1, 1933, 501 loans have been added to the mortgage loan account which represents loans refinanced and purchase money mortgages approved as eligible collateral for the banks' outstanding bonds.

The following table shows in detail the changes in the principal classes of assets and liabilities during the past year:

Changes in assets and liabilities during 1938 and 1939, excluding banks in receivership

Item	Amount outstanding Dec. 31		Amount of change during year		Percent change during year	
	1938	1939	1938	1939	1938	1939
ASSETS	[In thousands of dollars]					
Mortgage loans	83,467	62,878	−15,809	−20,589	−15.9	−24.7
Purchase money mortgages, contracts, etc.	24,036	22,212	−1,206	−1,824	−4.8	−7.6
Cash and securities	16,741	25,439	−335	8,698	−2.0	52.0
Real estate, sheriffs' certificates, etc.	41,520	36,911	−7,729	−4,609	−15.7	−11.1
Other assets	2,761	2,102	−748	−659	−21.3	−23.9
Total	168,525	149,542	−25,827	−18,983	−13.3	−11.3
LIABILITIES						
Bonds	111,373	96,871	−21,799	−14,502	−16.4	−13.0
Notes payable	8,293	7,611	1,130	−682	15.8	−8.2
Miscellaneous liabilities	5,424	3,850	−495	−1,574	−8.4	−29.0
Capital stock and paid-in surplus	34,117	33,858	−1,610	−259	−4.5	−.8
Earned surplus, reserves, and undivided profits	9,318	7,352	−3,053	−1,966	−24.7	−21.1
Total	168,525	149,542	−25,827	−18,983	−13.3	−11.3

The changes in total assets and bonds and notes payable as well as the changes in the principal classes of assets for individual banks are shown in tables 80 and 81 in the appendix.

Real Estate

During the year 1939, joint stock land banks disposed of real estate, sheriffs' certificates, and judgments representing 1,699 farms and 328 parts of farms with an investment of $11,769,610 and a carrying value of $9,564,863. The total consideration for the foregoing sales was $9,391,249, which equaled 79.8 percent of the investment and 98.2 percent of the carrying value. This may be compared with 1,678 farms and parts of 349 farms sold in 1938 with a total investment of $11,010,840 for a consideration of $9,480,106, which represented 86.1 percent of the investment and 104.6 percent of the carrying value.

In 1939, a total of 887 farms, sheriffs' certificates and related items were acquired representing an investment of $5,644,938. The preceding year, 866 items were acquired, representing an investment of $4,840,860.

The number of units, the investment in and recoveries made on real estate sold, the investment in real estate acquired, together

with the investment in real estate owned at the end of each year is shown in the following table:

Farms and sheriffs' certificates sold and acquired during each year, and on hand at end of year, May 1, 1933–Dec. 31, 1939

Period	Sold				Acquired		On hand Dec. 31	
	Number		Investment	Percent of investment recovered	Number	Investment	Number	Investment
	Whole	Part						
May 1 to Dec. 31, 1933	1,740	340	$12,091,463	74.7	2,290	$16,838,650	8,041	$62,567,848
1934	3,315	479	20,169,479	82.4	3,844	25,230,061	8,565	67,781,437
1935	3,099	513	19,954,312	90.6	3,714	23,944,854	9,149	72,830,026
1936	2,967	629	20,349,337	90.5	2,298	15,562,652	8,464	67,416,767
1937	2,558	502	18,146,269	94.7	1,266	9,026,921	7,098	58,412,836
1938	1,678	349	11,010,840	86.1	866	4,840,860	6,180	50,976,700
1939	1,699	328	11,769,610	79.8	887	5,644,938	5,325	44,886,722
Total	17,056	3,140	113,491,310	86.5	15,165	101,088,936		

Bond Operations

Funds obtained from the liquidation of the banks have been used to pay off notes and to retire bonds through the call of outstanding issues or the purchase of bonds in the open market. The decrease of total bonds and notes payable outstanding for all banks from May 1, 1933, through December 31, 1939, amounts to 74.8 percent. The variations among the individual banks in this respect are similar to the variations in the percentage of assets liquidated.

In 1939 the reduction in outstanding bonds in the hands of investors amounted to $14,501,935, while notes payable decreased $682,219, making a total decrease in such obligations of $15,184,154, or 12.7 percent.

The changes for the past year in the outstanding bonds of the joint stock land banks is summarized in the following table:

Outstanding Dec. 31, 1938:		
In hands of investors	$111,372,798	
Banks' own bonds on hand	1,693,050	
		$113,065,848
Issued during 1939		12,364,000
Total		125,429,848
Retired during 1939		27,812,985
Outstanding Dec. 31, 1939:		
In hands of investors	96,870,863	
Banks' own bonds on hand	746,000	
		97,616,863

During 1939 the total refunding bonds issued by 10 banks amounted to $12,364,000. Since May 12, 1933, a number of banks have placed themselves in position to issue refunding bonds by securing their outstanding bonds with eligible collateral by means of loans obtained on security of ineligible assets. Since the beginning of liquidation, 16 banks have issued refunding bonds aggregating $66,984,000. These refunding issues have borne interest rates ranging from one-half to 4 percent.

During 1939 a total of $22,659,400 of bonds was called at par by 23 banks. These figures include calls for bonds incident to refunding operations together with calls where banks used the proceeds from the liquidation of assets to retire these obligations. In addition to paying off some bonds which matured during the year and calling some for redemption, others were purchased prior to maturity. The total amount of bonds retired by all banks aggregated $27,812,985.

The bonds issued and retired in 1939 by each bank and the amount that was outstanding on December 31, 1939, is shown in table 86 of the appendix.

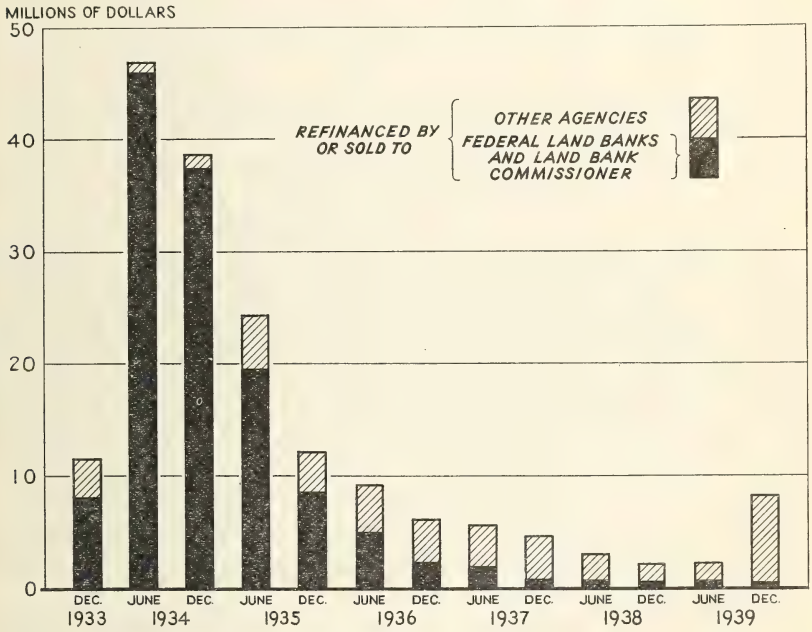


FIGURE 16.—LOANS REFINANCED OR SOLD BY JOINT STOCK LAND BANKS NOT IN RECEIVERSHIP

Financial Condition

On December 31, 1939, 20.3 percent of the $63,523,319 that the joint stock land banks had outstanding in mortgage loans was delinquent, as compared with 22.6 percent at the end of the preceding year. At the close of 1939 the banks had 15,166 loans outstanding upon which no installments were in default. These loans totaled $50,612,736, or 33.7 percent of the banks' total assets. At the same time the banks had 2,666 delinquent loans totaling $12,910,583. These loans represented 8.6 percent of their entire assets.

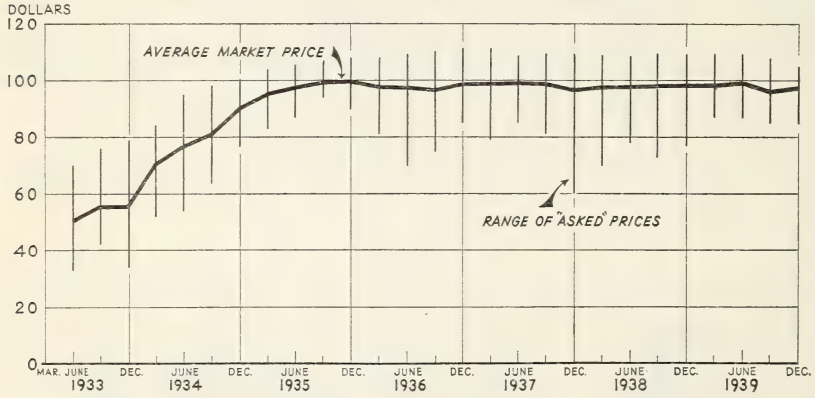


FIGURE 17.—AVERAGE MARKET PRICE, AND RANGE OF ASKED PRICES FOR JOINT STOCK LAND BANK BONDS, AS OF LAST DAY OF EACH QUARTER

Other interest-bearing assets on December 31, 1939, consisted of purchase money mortgages, real estate sales contracts, and notes receivable, aggregating $22,212,476, or 14.8 percent of the total assets. Of this amount, delinquencies comprised $5,513,463. Cash and securities on hand amounted to $25,439,161, or 16.9 percent of total assets. Real estate, sheriffs' certificates, and judgments constituted 24.6 percent of the banks' assets, compared to 24.5 percent on December 31, 1938. At the end of 1939, real estate, sheriffs' certificates, judgments, together with other low-income-producing assets such as delinquent loans, mortgages, and contracts, constituted 48.0 percent of the total assets of the banks, while for the year 1938 such items constituted 49.9 percent of the total assets.

During 1939, 17 of the 35 banks operated at a cash gain, while 12 out of 38 banks showed a cash gain from operation in 1938. A number of the banks improved their financial position during 1939 by refinancing their bonds bearing high interest rates with bonds or loans bearing lower rates. Total cash operating income received from all sources by the banks amounted to $8,274,090, while the total disbursement

for interest and bank operating expenses aggregated $8,718,752, showing a net cash operating loss of $444,662.

The Farm Credit Administration approved the payment of 10 dividends, including the final liquidating dividend of 3 banks, during 1939.

The California Joint Stock Land Bank paid a final liquidating dividend of $133,460 on May 23, 1939, to stockholders of record as of November 10, 1938; this brought the total liquidating dividends up to $246.57 per share of capital stock. On March 18, 1939, the Farm Credit Administration approved a final liquidating dividend of $479,442 by the Greensboro Joint Stock Land Bank, Raleigh, N. C., which brought the total of such dividends up to $226.78 per share of capital stock. The Greenbrier Joint Stock Land Bank, Charleston, W. Va., paid a first and final liquidating dividend under its plan of liquidation which amounted to $3.89 per share on 50,000 shares of $5 par value capital stock. This dividend was approved by the Farm Credit Administration on January 16, 1939.

Under their plans of voluntary liquidation, two banks made disbursements to their stockholders during the year. The Illinois Joint Stock Land Bank of Monticello, Ill., paid two dividends—one for 20 percent on April 14, 1939, to stockholders of record as of April 4, 1939, and one for 15 percent on December 15, 1939, to stockholders of record as of December 5, 1939. The Kentucky Joint Stock Land Bank of Lexington, Ky., paid one of $35 and one of $100 per share on outstanding stock to stockholders of record as of June 1 and November 25, 1939, respectively.

In addition, three other banks made disbursements to their stockholders during the year. The First Joint Stock Land Bank of Fort Wayne, Ind., paid $35 per share on outstanding capital stock to stockholders of record as of November 25, 1939; the Pacific Coast Joint Stock Land Bank of Salt Lake City, Utah, paid $20 per share on July 1, 1939; and the Union Trust Joint Stock Land Bank of Indianapolis, Ind., paid a dividend amounting to 6 percent of the par value of its outstanding capital stock on December 30, 1939.

In addition to the 10 foregoing dividends, on December 20, 1939, the Minneapolis-Trust Joint Stock Land Bank paid a 5-percent liquidating dividend on its certificates of participation, issued under the bank's plan of voluntary liquidation adopted in 1934. Dividends equivalent to 42 percent of the original amount of these participating certificates have been paid through December 31, 1939.

Loans to Joint Stock Land Banks

As a means of assisting the liquidation of the joint stock land banks, sections 30 and 31 of the Emergency Farm Mortgage Act of

1933 authorized the Reconstruction Finance Corporation to make available to the Land Bank Commissioner the sum of $100,000,000 for a 2-year period. These funds were available to the joint stock land banks only under certain specified conditions. Since none of the banks applied for loans under section 30 of that act, authority for granting such loans, after several extensions, was allowed to expire on May 13, 1937.

A total of $2,082,679 in loans was made to 12 banks under section 31 prior to the enactment of the Farm Credit Act of 1937 which reduced the amount available for loans under section 31 from $25,000,000 to $2,000,000 and provided that these funds be supplied by the Federal Farm Mortgage Corporation. No disbursements were made by the Federal Farm Mortgage Corporation under this provision and authority to make these loans expired on July 1, 1938. On December 31, 1939, there were outstanding loans aggregating $17,935 to two banks.

Under the provisions of the Farm Credit Act of 1937, the Federal Farm Mortgage Corporation was also authorized to make loans to joint stock land banks on the security of real estate mortgages, sheriffs' certificates, sales contracts, and real estate upon terms and conditions to be prescribed by the directors of the Corporation, with the limitation, however, that the aggregate of such loans may not at any one time exceed $10,000,000. No loans so far have been made to joint stock land banks under this provision.

Joint Stock Land Banks in Receivership

Altogether nine joint stock land banks have been placed in the hands of receivers. Final liquidating dividends have been declared and paid to all bondholders who delivered their bonds and proved their claims to the respective receivers of three banks; namely, the Kansas City Joint Stock Land Bank of Kansas City, Mo., the Ohio Joint Stock Land Bank of Cincinnati, Ohio, and the Bankers Joint Stock Land Bank of Milwaukee, Wis. Funds to which the holders of unpresented bond obligations of these three banks are entitled are held by the Treasurer of the United States subject to the order of the Governor of the Farm Credit Administration. Information concerning the filing of claims on such unpresented bond obligations may be obtained by addressing the Farm Credit Administration, Washington, D. C.

Six banks are still in process of liquidation, the last of which was placed in receivership January 12, 1938. The receivers of five of the six banks currently being liquidated have paid liquidating dividends to bondholders who have made delivery of their bonds to the respective receivers and proved their claims. Those holders of bond obligations who have not made delivery to the receiver and proved

their claims will receive the dividend or dividends to which they are entitled when proper proof of their claims is made.

Progress in Liquidation

The six banks in receivership on which final liquidating dividends have not been declared and the dates they were placed in receivership are as follows:

Southern Minnesota Joint Stock Land Bank of Minneapolis	May 2, 1932
St. Louis Joint Stock Land Bank of St. Louis	June 1, 1932
Chicago Joint Stock Land Bank of Chicago	Oct. 1, 1932
Oregon-Washington Joint Stock Land Bank of Portland	May 1, 1936
Burlington Joint Stock Land Bank of Des Moines	Dec. 12, 1936
Northwest Joint Stock Land Bank of Portland	Jan. 12, 1938

The progress made in liquidating these six banks during 1939 is indicated in the following table:

Reduction of assets of joint stock land banks in receivership during 1939

Assets	Book amount on Dec. 31		Change during 1939	
	1938	1939	Amount	Percent
Mortgage loans	$3,758,092	$2,772,783	−$985,309	−26.2
Purchase money mortgages and contracts	3,594,354	3,794,483	200,129	5.6
Real estate, sheriffs' certificates, etc	12,365,568	9,916,446	−2,449,122	−19.8
Other assets except cash and securities	70,782	76,863	6,081	8.6
Total	19,788,796	16,560,575	−3,228,221	−16.3
Cash and securities	5,543,811	4,208,981	−1,334,830	−24.1
Grand total	25,332,607	20,769,556	−4,563,051	−18.0

Of the reduction in the amount of mortgage loans, $631,812 resulted from sale or refinancing. The average recovery on the disposition of these loans was 96.1 percent of the book value. During the year, 403 farms and sheriffs' certificates and 26 parts of farms which represented a book value of $2,894,930 were sold by the receiverships for a total consideration of $1,955,122, or 67.5 percent of their book value.

Additional details relating to the operations of the receivers are shown in tables 88 to 90, inclusive, of the appendix.

Burlington Joint Stock Land Bank Receivership

The Burlington Joint Stock Land Bank of Des Moines was chartered in 1923. On the date the bank was placed in receivership it had a total of $667,400 outstanding farm loan bonds while the book value of the bank's total assets was $849,191.

Following the initial dividend of 25 percent which was paid on July 31, 1938, further dividends of 10 percent each were declared payable as of April 20, 1939, and September 29, 1939, to holders of bond obligations of the bank who delivered them to the receiver and proved their claims. On December 31, 1939, the remaining assets of the trust had a book value of $209,416 which included $68,175 in cash.

Chicago Joint Stock Land Bank Receivership

The corporate name of the Chicago Joint Stock Land Bank when originally chartered in 1917 was the First Joint Stock Land Bank of Chicago. Since that time the name has been changed to the Chicago Joint Stock Land Bank. On October 1, 1932, the date the bank was placed in receivership, the book value of the bank's assets aggregated $44,739,586 and the par amount of its bonds outstanding was $42,724,100.

On September 14, 1934, the initial dividend of 30 percent of the bond obligations of the bank was declared; three dividends of 10 percent each were declared in 1935, two of 5 percent each in 1936, one of 2½ percent in 1937, one of 2½ percent in 1938, one of 1½ percent on April 25, 1939, one of 1¼ percent on November 28, 1939, and one of one-fourth of 1 percent on November 28, 1939. The one-fourth of 1 percent dividend represents a first dividend from unpledged funds to holders of claims based on bond obligations of the bank which have been allowed on or before November 22, 1939. These dividends aggregate $34,012,914 and are equivalent to 78 percent of the par amount of bond obligations of the bank which had not matured prior to October 1, 1932. In addition to the foregoing dividends, a first and final dividend in the amount of $44,754—which is equal to the amount of the unpaid coupons of the bank's bonds which matured prior to October 1, 1932—was declared March 8, 1935, from funds set aside in trust by the bank prior to receivership for the payment of such coupons. This dividend was payable to the registered holders of the certificates issued by the receiver whose names appeared on the books of the receiver at the close of business on March 15, 1935. Holders of bond obligations of the bank who have not made delivery to the receiver and proved their claims will receive the dividend or dividends to which they are entitled when proper proof of their claims is made. At the end of 1939 the book value of the remaining assets of the bank totaled $3,237,223 which included $324,639 in cash.

Oregon-Washington Joint Stock Land Bank Receivership

The Oregon-Washington Joint Stock Land Bank of Portland was chartered in 1922. At the time the bank was placed in receivership

it had outstanding farm loan bonds aggregating $2,038,500, while the total assets had a book value of $2,464,247.

The first liquidating dividend of 20 percent of the bond obligations was paid on April 30, 1938, and on May 1, 1939, a 10-percent dividend was paid to holders of such obligations who had made delivery to the receiver and proved their claims. On December 31, 1939, the trust had on hand assets with a total book value of $1,718,610, including $178,364 in cash and United States Government securities.

St. Louis Joint Stock Land Bank Receivership

The St. Louis Joint Stock Land Bank which was chartered in 1922 acquired the assets and assumed the liabilities of the Central Illinois Joint Stock Land Bank of Greenville and the Southeast Missouri Joint Stock Land Bank of Cape Girardeau. On June 1, 1932, the date the bank was placed in receivership, it had farm loan bonds outstanding in the amount of $18,134,500, and the book value of its assets was $18,581,815.

On May 1, 1935, the first dividend of 20 percent was declared and ordered to be paid to the holders of receiver's certificates registered on the books of the trust at the close of business on May 15, 1935. Two dividends of 10 percent each were paid on January 25 and November 28, 1936, respectively, and a similar dividend as of February 18, 1939, was paid. The total amount of these dividends aggregated $9,207,353. Payment of additional dividends has been deferred pending disposition of litigation affecting the assets of the trust. At the end of 1939 the trust had on hand assets with an aggregate book value of $6,120,551, including $3,264,275 in cash.

The bondholders' protective committee published a plan on October 16, 1934, under which the committee proposed to take over and liquidate the bank's assets. This plan which was described in the Second Annual Report of the Farm Credit Administration was abandoned by a resolution adopted by the committee on October 7, 1938.

Southern Minnesota Joint Stock Land Bank Receivership

The Southern Minnesota Joint Stock Land Bank of Minneapolis was chartered in 1919 under the corporate name of Southern Minnesota Joint Stock Land Bank of Redwood Falls, Minnesota, where it was then located. In 1923, this bank acquired the assets and assumed the liabilities of the First Joint Stock Land Bank of Minneapolis. Its principal office was moved to Minneapolis in 1926 and its corporate name was changed to the Southern Minnesota Joint Stock Land Bank of Minneapolis. On the date of receivership, May 2,

1932, the bank had outstanding farm loan bonds totaling $21,038,700, and assets with a total book value of $22,658,955.

A first dividend of 20 percent of the bond obligations of the bank was paid to holders of receivers' certificates registered on the books of the trust as of January 31, 1935. Dividends of 10, 6, 4, and 2 percent have been paid to registered holders as of September 30, 1935, June 24, 1937, August 3, 1938, and November 27, 1939, respectively. As of December 31, 1939, the assets of the trust had an aggregate book value of $9,471,278, including $365,775 in cash.

Northwest Joint Stock Land Bank Receivership

The Northwest Joint Stock Land Bank was chartered in 1922, and adopted a plan of voluntary liquidation in 1925. Pursuant to this plan, the Federal Land Bank of Spokane assumed the outstanding bonds of the bank and took over all of the loans and other assets except certain items having a present estimated recovery value of about $15,000. In order to expedite its final liquidation a receiver was appointed on January 12, 1938. Since these assets were located in the territory of the Oregon-Washington receivership, the receiver of that trust was appointed receiver of the Northwest receivership as well. On December 31, 1939, the assets of the trust had an aggregate book value of $12,478, including $7,752 in cash.

Washington Office of the Farm Credit Administration

As with every large business institution, the Farm Credit Administration, in addition to its operating divisions which are charged with the direct responsibility of supervising the activities of various lending institutions, integrates many of its activities through closely coordinated service divisions in the Washington office which also cooperate with the 12 district offices of the Farm Credit Administration.

In the Administrative Division a central personnel office, cooperating with personnel officers in the field, continued to administer and develop personnel policies and practices for the maintenance of employees' efficiency and morale during the past year. The Planning Subdivision served both the Washington and district offices in matters relating to organization, procedure, and business methods.

As directed by Congress, the Division of Information and Extension disseminated through avenues of the press and radio and through pamphlets and other publications information concerning the functions and activities of the Farm Credit Administration. However, the largest share of its efforts were devoted to the carrying on of an extension program which includes cooperation with operating divisions in helping to develop the necessary materials for use in their member-

ship and educational programs. It also includes cooperation with the Extension Service of the Department of Agriculture and the Office of Education of the Federal Security Agency in an effort to promote greater knowledge on the part of farmers as to the wise use of credit and the usefulness of their cooperative credit, marketing, purchasing, and business service organizations as an aid to farmers in their efforts to improve their standard of living. By cooperating with the Extension Service and the Office of Education, the Division makes available materials on these subjects to farm boys and girls who will be our farm families of the future, as well as to people now engaged in farming. Recognizing that any cooperative organization is dependent to a large extent for its success on the intelligent interest and support of its members, the Division, in cooperation with the Cooperative Research and Service Division, developed a new series of circulars discussing various types of farmer cooperatives from the standpoint of the individual member or prospective member, with particular emphasis being placed on the members' duties and responsibilities to his organization.

The work of the other divisions of the Washington office are discussed in the sections of the report which follow.

Examination Division

The Examination Division is responsible for making examinations of all institutions and agencies operating under the jurisdiction of the Farm Credit Administration, with the exception of the emergency crop and feed loan offices. It is also responsible for analyzing and interpreting the information contained in examination reports. In addition, it conducts such special or confidential investigations as are authorized by the Governor.

The divisional examining offices operate under the direction of supervising examiners and these are located at Washington, D. C., Memphis, Tenn., St. Paul, Minn., and Portland, Oreg.

A summary of the number of institutions examined, the number of examinations scheduled, and the number of examinations completed during the year ended December 31, 1939, is shown in the table on page 108.

Legal Division

The litigation of credit institutions operating under Farm Credit Administration supervision, except that of a local character, is supervised by the Litigation Section of the Legal Division. The banks and corporations of the farm credit system report all cases which involve the interpretation of acts of Congress, rules and regulations issued

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Examinations scheduled and made during 1939

Organization	Number of organizations examined	Number of examinations scheduled	Number of examinations made
Bank and corporation unit:			
Federal land banks	12	24	[1] 24
District offices of the Federal Farm Mortgage Corporation	12	24	[1] 24
Federal intermediate credit banks	12	24	[1] 24
Production credit corporations	12	12	[2] 14
Banks for cooperatives	13	26	[3] 26
Registrars' offices	12	24	[4] 25
General agents' offices	12	24	24
Federal Farm Mortgage Corporation	1	2	2
Bond and Cash Section	1	1	1
Custodian of Securities	1	1	1
Office of Fiscal Agent	1	2	2
Washington Accounting Section	1	1	1
Agricultural Marketing Act revolving fund	1	1	1
Regional agricultural credit corporations	7	12	[5] 12
Joint stock land banks in receivership	9	15	15
Joint stock land banks	38	73	[6] 73
Association unit:			
National farm loan associations	4,642	4,642	[7] 4,642
Loan correspondents	517	517	[8] 517
Production credit associations	549	549	[9] 549
Credit union unit: Federal credit unions	2,721	2,721	[10] 2,721

[1] Puerto Rico office included but not counted separately.
[2] Includes 2 special examinations of the Columbia and St. Paul Production Credit Corporations.
[3] Includes the Central Bank for Cooperatives.
[4] Includes 1 special examination.
[5] Regional Agricultural Credit Corporation of Spokane, Principal Office and Boise Branch Office examined once; merged with Regional Agricultural Credit Corporation of Salt Lake City.
[6] Includes 3 final examinations.
[7] Excludes 28 reexaminations and 5 special investigations.
[8] Excludes 1 special investigation.
[9] Excludes 1 reexamination and 2 special investigations.
[10] Excludes 4 liquidation examinations made in the Washington office.

thereunder, or the legal effect of uniform business practices. This procedure insures uniformity in the presentation of legal questions to the courts and minimizes the duplication of legal research in the district offices.

The following is an outline of the most significant litigation of the past year.

Joint Stock Land Banks in Receivership

In the last annual report, reference was made to the case of *Ernest E. Andrews, et al.* v. *St. Louis Joint Stock Land Bank, et al.*, in which the United States District Court for the Eastern District of Missouri had affirmed a long-standing administrative interpretation of the Federal Farm Loan Act, with respect to the collateral security for farm loan bonds issued or assumed by a joint stock land bank. The

court held that all bond obligations of the insolvent St. Louis Joint Stock Land Bank were collectively secured by all farm mortgages and other assets which had been deposited in trust with the farm loan registrar as collateral security for such bond obligations; and that none of the bond obligations were separately secured by specific assets on deposit with the registrar.

The plaintiffs appealed to the United States Circuit Court of Appeals for the Eighth Circuit, which affirmed the judgment of the district court in June 1939. Thereafter, the plaintiffs applied for a rehearing, and the case was reargued. In November 1939 the circuit court reversed its prior decision and the judgment of the district court.

The November decision held that the bond obligations of the St. Louis bank are of two distinct classes, and that the bonds of each class are separately secured by collateral which must be liquidated for the benefit of the holders of bonds of that particular class. The court thus distinguished between (1) bonds which the St. Louis bank had issued, and (2) similar bonds for which the St. Louis bank had assumed full and unconditional liability, upon voluntary liquidation of the issuing bank, whose assets were acquired and liabilities assumed by the St. Louis bank, as expressly authorized by the Federal Farm Loan Act.

Shortly after the November decision was announced, the receiver of the St. Louis bank applied for a rehearing, pointing out that the conclusions stated by the court were diametrically opposed to the administrative interpretation of the Federal Farm Loan Act which, for more than 20 years, has governed the bond and collateral transactions—aggregating billions of dollars—of all Federal and joint stock land banks. The court declined to reconsider the case, or to modify its decision. However, the court granted the receiver's application for a stay of mandate, in order to permit submission of the case to the Supreme Court of the United States before the decision should become effective. At the close of 1939, the receiver's counsel were engaged in preparing the case for submission to the Supreme Court.

Detailed statements concerning the history of the *Andrews case*, and the parties and issues involved, are contained in the last four annual reports. Throughout the long and complicated litigation of the suit Farm Credit Administration attorneys have cooperated with the receiver of the joint stock land bank and his counsel.

The case of *Bankers Farm Mortgage Company* v. *United States of America*, which was described at some length in the last annual report, is still pending in the Court of Claims.

Taxation Affecting Farm Credit Administration Units

In the last annual report, mention was made of a case pending in the Supreme Court of North Dakota involving the right of the Federal Land Bank of St. Paul to purchase gasoline without paying the North Dakota gasoline tax. This case has since been decided by the court adversely to the bank. Consideration was given to the advisability of taking an appeal to the United States Supreme Court, but it has been decided not to make such an appeal.

The right of the State of North Dakota to impose a sales tax on the sale of merchandise to the Federal land bank is still pending before the supreme court of the State. The court ordered a reargument of its own motion.

Mention was made also in the last annual report of a case in Mississippi involving the right of the Federal Land Bank of New Orleans to operate automobiles in that State without the payment of the ordinary license-plate tax. The State had taken the position that the bank which had heretofore been permitted to operate without the purchase of the ordinary license plates must now purchase plates. The trial court determined the issues adversely to the bank, but on appeal to the circuit court the decision was reversed. The case will in all probability be taken to the supreme court of the State.

Loans for Purchase of Stock in Agricultural Credit Corporations

There is now pending before the Circuit Court of Appeals for the Ninth Circuit, in the case styled *United States* v. *J. A. Burleigh*, an appeal from the judgment entered by the United States District Court for the District of Oregon dismissing the Government's action to recover on a promissory note given by the defendant in renewal of a prior note evidencing a loan made to the defendant under Public, No. 666 of the Seventy-first Congress, which authorized the Secretary of Agriculture to make loans for the purpose of purchasing stock in agricultural credit corporations. The defendant interposed a defense to the effect that he had never received value for the execution of the note, and charged a conspiracy to defraud him by persuading him to purchase worthless stock.

Emergency Crop and Feed Loans

An important case in connection with the emergency crop and feed loan program, entitled *United States of America* v. *W. T. Thomas, et al.*, was recently decided in favor of the Government by the United States Circuit Court of Appeals for the Fifth Circuit. This case involved suits brought by the Government in the United States District Court

for the Northern District of Texas to recover from the purchasers of cotton subject to mortgages executed as security for 1935 emergency crop loans granted by the Governor of the Farm Credit Administration. The defenses raised by the purchasers were: (1) that the United States through the conduct and acts of its agents and employees had waived the mortgage liens; (2) that the Texas statute of limitation barred the actions. On behalf of the Government it was asserted that the acts and conduct of the agents and employees of the United States did not operate to waive the mortgage liens, and that the agents and employees were not authorized to waive such liens. The defense of limitation was opposed on the ground that the United States, when asserting governmental rights, is not subject to State statutes of limitation, and that the United States in making the 1935 emergency crop loans and attempting to collect such loans was acting in its governmental capacity. The district court ruled against the Government's contentions on both points and dismissed the claims against the purchasers. An appeal was taken by the Government to the Fifth Circuit Court of Appeals. The circuit court reversed the district court's judgment and held that waiver was not a good defense inasmuch as the agents and employees of the United States had no authority to waive the mortgage liens, and that there was no merit in the defense of the Texas statute of limitations inasmuch as the United States is not subject to State statutes of this kind in the absence of a manifestation by Congress of an intent to be bound thereby.

The question of the applicability of State statutes of limitation to claims arising out of emergency crop and feed loans is also raised in a case pending in the United States Circuit Court of Appeals for the Eighth Circuit. This case, entitled *L. K. Person* v. *United States of America,* involves an indebtedness arising out of an emergency crop loan granted in 1931 by the Secretary of Agriculture. A suit was instituted in the United States District Court for the Western District of Arkansas to recover the amount of the loan remaining unpaid. The borrower pleaded the statute of limitation of Arkansas as a defense to the suit. The contention on behalf of the Government was that the indebtedness represented a debt due to the United States, that the emergency crops loan had been made by the Government itself acting in its governmental capacity, and that therefore the State statute of limitation did not apply. The district court ruled against the borrower and entered judgment in favor of the Government. An appeal was taken to the Eighth Circuit Court of Appeals, where the case is now pending.

Miscellaneous Litigation

During the past year 518 civil cases arising in connection with emergency crop and feed loans have been forwarded to the Attorney General and to the various United States attorneys for consideration. A total of 3 cases involving loans to purchase stock in agricultural credit corporations previously granted by the Secretary of Agriculture and 31 cases involving loans now under the supervision of the Cooperative Division and the Revolving Fund Section have also been referred to the Attorney General. Collections amounting to $456,833.08 have been made during the year as a result of these and other cases previously forwarded to the Attorney General.

A total of 139 cases were brought by or against the regional agricultural credit corporations during the past year. In connection with these cases, and similar cases previously instituted, collections amounting to $141,742.21 have been made.

In addition to these civil cases, 45 cases involving apparent violations of the criminal provisions of various Federal statutes occurring in transactions under the supervision of the Farm Credit Administration have been referred to the Secret Service for investigation and appropriate action and 110 cases to the Attorney General for such action as he deemed advisable.

The filing of claims against sureties under fidelity bonds has also been under the supervision of the Litigation Section, and in connection with such claims collections of $2,180.38 have been made.

The Litigation Section has likewise given attention to the various phases of 1,504 bankruptcy cases involving persons and corporations indebted to the Farm Credit Administration or to institutions operating under its supervision. Many of these cases have arisen under the provisions of section 75 of the Bankruptcy Act, as amended by the second Frazier-Lemke Act, authorizing the agricultural composition of debts and extensions.

During the year the Litigation Section closed its files on 984 civil cases and 190 criminal cases. At the close of the year, 1,656 pending cases were on its dockets.

Division of Finance and Accounts

The Division of Finance and Accounts is primarily a service division, furnishing the operating divisions of the Farm Credit Administration in Washington and the various banks, corporations, and offices throughout the United States which the Administration supervises continuous services in the fields of finance, accounting, and reports.

The Division made studies of the financial operations of all units supervised by the Farm Credit Administration. Based upon such studies, it made recommendations to, and executed on behalf of, the institutions, approved programs involving transactions such as the issuance and redemption of farm loan bonds and Federal intermediate credit bank debentures, the purchase and sale of securities for investment accounts, and the handling of cash and securities through the Federal Reserve banks and the Treasury Department.

Through the 12 farm loan registrars, 1 in each farm credit district, the Division of Finance and Accounts maintained, as heretofore, custody and appropriate records of all mortgages, notes, and other collateral deposited as security for bonds and debentures issued by the Federal land banks, joint stock land banks, and Federal intermediate credit banks, and has in safekeeping loan documents and related papers for the Federal Farm Mortgage Corporation and district banks for cooperatives.

The Division maintained books of account of the Agricultural Marketing Act revolving fund, the Central Bank for Cooperatives, the Central Office of the Federal Farm Mortgage Corporation, the control accounts of the emergency crop and feed loan offices, the accounting records covering appropriation and fund accounts and budgetary transactions, and carried on the administrative audit.

Through 12 district comptrollers, 1 in each farm credit district, the Division directed and supervised the internal audit program in the Federal land banks, Federal intermediate credit banks, production credit corporations, and banks for cooperatives, and exercised its supervisory responsibilities in connection with the maintenance of uniform accounting systems in the banks and corporations.

The Division reviewed and analyzed financial, operating, and statistical reports received periodically from the banks, corporations, and offices under the supervision of the Farm Credit Administration, and compiled therefrom the required financial, operating, and statistical reports, including the quarterly reports published for distribution to the general public.

Economic and Credit Research Division

The Economic and Credit Research Division conducts economic research relating to problems confronting the credit units comprising the Farm Credit Administration. The Division's program of research is carried on independently or in cooperation with the farm credit districts, in each of which a director of research or a statistician conducts research on problems of particular importance in that district.

In some studies the cooperation of the State agricultural experiment stations also has been obtained.

Studies made by the Division during 1939 include an analysis of the price situation for several agricultural commodities, to be used in determining credit policy on short-term and long-term loans. A survey of the experience of discount corporations was made to discover the reasons for failures. The year saw the completion of a study of the probable effects on the Farm Credit Administration of the proposed taxation of Federal, State, and municipal securities. The Division studied Federal Credit Union losses on unsecured loans and their accumulation of share balances. An analysis of their operations also was made to determine the reasons for liquidation of certain credit unions. Income and expense data on livestock ranches were analyzed to provide information for use in the determination of credit policies on range livestock loans. The Division made analyses of the land bank and Federal Farm Mortgage Corporation real estate operations with special reference to the success of sales and the cost of holding properties. The Division continued its studies of agricultural credit in foreign countries and the compilation of data on farm mortgage recordings and foreclosures by areas.

In addition to this work the Economic and Credit Research Division cooperated with the farm credit district research divisions in making several studies of both long- and short-term credit problems. One of these sought to determine the value of land classification data as a guide in making farm mortgage loans. Another study concerned the use, cost, and adequacy of short-term and long-term credit in selected areas. The subject of a third study was the loan experience of the land banks and production credit associations in problem areas, with the object of determining factors that should be considered in adopting loan policies for such areas. The district divisions of research participated in studies of land bank loan mortality and loss experience from their organization to date to determine the reserves that should be set aside for losses on loans. Numerous other studies were made by the district research divisions on problems confronting the credit units in their respective districts.

Cooperative Research and Service Division

Cooperative marketing of farm products and cooperative purchasing of farm supplies and services continues to be one of the major methods used by farmers for improving their economic conditions. More than one-third of the farmers in the United States are participating in the movement. The value of products marketed and farm supplies purchased during the 1938–39 marketing season amounted to $2,100,-

000,000. Of the 10,700 cooperatives in the above groups, 8,100 were engaged primarily in marketing and 2,600 in purchasing farm supplies.

In addition to the farmers' associations engaged in marketing farm products and purchasing farm supplies, there are several thousand organizations furnishing essential business services to farm families. There are about 1,900 mutual fire-insurance companies operating in the United States, with about 11 billion dollars of insurance in force. It is estimated that there are approximately 2,000 mutual irrigation companies and about 600 farmers' associations supplying their members with electricity for light or power on a cooperative basis. There are several thousand farmers' mutual telephone companies and a large number of associations where farmers are cooperating in various phases of their production activities.

The scope of the activities carried on by farmers' cooperatives gives some indication of the great diversity of their problems. It is the function of the Cooperative Research and Service Division to assist these associations in rendering the most efficient service to their members. This assistance is given in various ways. In some cases requests can be handled by conferences with the manager or other officials, or meetings with the boards of directors. In others a rather comprehensive study involving considerable research may be necessary in order to provide the information desired.

During the year members of the staff have discussed cooperative problems with about 5,000 officials of cooperative associations and more than 1,000 associations have been visited. In addition members of the staff have participated in over 500 meetings of officials and members of cooperatives.

One of the principal functions of the Division is to make available in printed form information on various phases of agricultural cooperation. Several series of publications are made available in an attempt to adapt the type of information to the particular group to be reached. During the year the Cooperative Research and Service Division in cooperation with the Division of Information and Extension inaugurated a new group of circulars called the "You and Your Co-op" series. Each of these circulars was written from the standpoint of the individual member or prospective member of a cooperative. Each circular describes in simple language the relationship between the member and his organization. In other words these circulars stress the duties and obligations which members must recognize if they are to get the best results from their cooperatives. Nineteen circulars have been issued in this series. They are being used extensively by county agricultural agents and vocational agricultural teachers in their programs of educating farmers and young people in the fundamental advantages and problems of cooperative organiza-

tions. Many cooperative associations themselves have requested copies for their officers and employees and in some cases purchased additional supplies from the Superintendent of Documents, Government Printing Office, for general distribution to members and prospects.

The Division has issued during the year 9 bulletins, 5 regular circulars, and 3 miscellaneous reports. In addition 21 reports giving the results of special studies were prepared for officials of various cooperative associations.

At the end of the year there were 45 research projects under way. They included 2 relating to business administration, 3 to cotton, 4 to dairy, 12 to fruits and vegetables, 5 to grain, 2 to history and statistics, 4 to insurance, 2 to livestock and wool, 4 to poultry and eggs, 5 to purchasing, and 2 to special crops. Close working relationships are maintained with agricultural colleges and other educational agencies in all the research, service and educational work. State colleges and experiment stations are formally cooperating on 18 of the above 45 research projects.

The following discussion relates to the work done with various types of cooperatives.

Business Administration

Cooperatives as business organizations are constantly confronted with the necessity of adjusting their operating methods to meet ever-changing conditions. In the merchandising field this has been particularly marked as the result of recent economic and legislative changes affecting the distribution of agricultural products.

The Division has endeavored to assist cooperatives facing problems of this nature and others. One of the projects undertaken in the merchandising field was the study of the sales operations of a large-scale association engaged in national distribution of fruit. Results of this study point the way toward changes in promotional efforts that could be followed to bring about increased effectiveness in the methods used by the association to stimulate demand for its products.

In developing a sound merchandising program for a cooperative, it is essential from a long-time point of view that the members have an understanding of the complexity of the job which they expect their organization to perform. Many progressive merchandising cooperatives have learned to study the wants of the consumer, his buying habits and motives, and to develop ways of influencing the consumer to buy their products. As one means of assisting producers to gain a better understanding of merchandising problems, Circular E–22, Merchandising by Farmers' Cooperatives, was prepared and published during the year by the Farm Credit Administration.

Cooperatives also face the problem of developing an adequate understanding by members, boards of directors, and management staffs of the responsibilities of each of these groups in the management of the association. A publication, Circular E–21, Managing Farmers' Cooperatives, directed primarily to members of associations and to vocational agriculture students, was also prepared and published during the year.

Cotton

Farmers have continued to organize cooperative gin associations at the same rapid pace which they established several years ago. Increases in numbers have been greatest in Texas and Mississippi. California farmers, the newest and most enthusiastic recruits to the cooperative ginning idea, lead in volumes ginned per plant and earnings per association.

The number of cooperative gins in all sections of the South now totals well above 550. Most of the increases are coming in areas new to cooperative ginning, but there have been some gains even in the communities where cooperative gins have been stable community institutions for several decades. The increase in the number of cooperative gins in the older communities brings with it the problem of competition between cooperatives in the same trade territories. This competition usually works to the detriment of all cooperative gin members in the territory because it usually lowers the volume for all associations. Lower volumes result in increased per-unit expense and smaller savings to the member. In the end the stronger associations will tend to crowd out the weaker neighboring cooperatives. The Division in its service work has assisted cooperative gin associations with the business problems arising largely from these and other conditions. Organization and other suggestions for new and old cooperative gin associations are incorporated in recently published circulars C–109 and E–9, and the development of these associations is traced in C–112. These publications are entitled "Organizing a Cooperative Cotton Gin," "Using Your Co-op Gin," and "Development of Cooperative Cotton Ginning," respectively.

There are now seven farmer cooperative oil mill associations operating in the South. Two are owned by federations of cooperative gins and the other five are of the centralized type in which farmers have direct membership in the oil mill association. Recent studies of the operations of cooperative oil mill associations over a 4-year period revealed that this type of cooperative was able to return to its members an average of about $5 per ton above the prevailing prices for seed in the community. The results of this study were published in Circular C–114, entitled "Crushing Cotton Seed Cooperatively."

Cooperative ginning and cottonseed oil milling associations continue to offer an excellent field for cooperative savings for cotton farmers.

The cooperative cotton warehouses established in Georgia several years ago have made substantial earnings which have gone a long way toward paying off the indebtedness incurred in the purchase of these plants. The savings through warehousing and through the sale of cotton direct to mills have proved to be a sound and worth-while activity for Georgia farmers in the four communities in which these cooperative cotton warehouses are being operated.

A member of the Division, together with the president of the Houston Bank for Cooperatives, Houston, Tex., spent some time in the spring and early summer in 1939 studying the new developments and improvements in the cotton quality, handling, and marketing practices in South Brazil, and the possibility of their adaptation to cooperative programs in this country. In recent years South Brazil, particularly in the State of Sao Paulo, has developed a coordinated plan for cotton promotion and improvement. The progress made during the past decade under this program would indicate that the American farmer and his cooperatives must develop in their own way a program for cotton improvement and marketing if they are to maintain their present relative competitive position in cotton markets of the world.

At the request of farmer cotton-improvement groups in the vicinity of Munday and Seymour, Tex., the Division also assisted with the development of a cooperative cotton brokerage service for members of a number of cooperative gins in that area. Despite the fact that drought cut this year's volume of sales, farmers are planning to continue the service next season. A number of other communities throughout the South have been operating a similar cooperative cotton sales service for several years.

The situation with regard to large-scale cooperative cotton marketing associations is largely unchanged from a year ago. The State and regional associations affiliated with the American Cotton Cooperative Association have received a substantially lower volume of cotton during the current season, although they have handled a substantial volume of loan cotton through their suspense pools and have assisted members in the sale of their loan equities. Deliveries to the Staple Cotton Cooperative Association, of Greenwood, Miss., are the largest on record for any season at this date. The association is continuing to provide an efficient marketing service for its Delta members through its factor pool and through its other sales option known as the "pool for shipment." In addition to the Staple Cotton Cooperative Association, the Southwestern Irrigated Cotton Growers Association, the North Carolina Cotton Growers Cooperative Association, the

California Cotton Cooperative Association, and the Alabama Cotton Cooperative Association are now operating their own independent sales services.

Dairy

Dairy cooperatives, although well-established business organizations with years of experience in most of the important dairy farming sections of the United States, are operating in a field which has been characterized by many rather marked changes in recent years. Some of these changes involve new methods of processing and marketing dairy products. Other changes involve new economic institutions in the marketing sphere, or different types of Federal, State, and local legislation dealing with marketing and production of dairy products. The job of meeting these changes, together with the ever-present job of improving and maintaining membership relations, which also changes as the cooperative grows older, are the major current problems of dairy cooperatives.

Among the cooperative creameries, many of the recent changes have related to marketing practices. One of the studies by the Division completed during the year was devoted to butter marketing methods used by cooperative creameries in the Middle West. The results are published in Bulletin 36, entitled "Butter Marketing by Cooperative Creameries in the Middle West." This study revealed that there are so many diverse methods of selling butter that creameries may easily be misled as to the best outlet. Variations in the point of quotation, the amount of premium, and the type of package tend to confuse the issue. The safest procedure appears to be to convert all settlements to the basis of net prices at the churn.

The operations of one of the more successful cooperative regional sales agencies handling butter and other dairy products was studied by the Division during the year with the objective of describing and analyzing this approach to the marketing problem. Special emphasis was given in the study to the marketing procedures and to the cooperative features binding the local creameries together. The results are intended to serve as a guide to other regionals and to other groups of locals interested in developing a regional sales agency.

Research in the cooperative marketing of fluid milk during the year has been directed at the problems of the membership relations of bargaining associations, the program of the milk associations operating in markets that are under governmental control, and the expansion of the cooperatives' services to the operation of bottling plants or plants manufacturing surplus milk into dairy products. An analysis of the operations of the Falls Cities Cooperative Milk Producers Association, published as Bulletin No. 32, provided helpful information on the first

two problems. According to interviews with its producer-members, this association has maintained excellent relations with its membership. At the same time, although it has operated in a market that has been under governmental control since 1934, the cooperative has continued to expand its marketing and service program. The methods used by this association should be equally successful in many other areas.

The number of milk cooperatives engaged in distributing milk or operating plants which manufacture surplus milk into various dairy products has increased markedly in recent years. Ventures into these fields, however, are not universally successful and involve a number of complex financial and operating problems not encountered by bargaining associations. In order to enable the Division to supply information to cooperatives as to operating methods and results, circumstances leading up to entrance into the fields, financial requirements, and the possibilities and limitations of such cooperatives, the Division has started a study which will give it more information on factors affecting the successful operations in these fields.

Fruits and Vegetables

During 1939 the fruit and vegetable cooperatives showed increased interest in problems relating to the distribution of their products in terminal markets. Large supplies and low prices of fruit and vegetables have impressed them with the necessity of eliminating unnecessary services and duplicating agencies in all phases of marketing. They also are interested in information which will enable them to develop effective methods of promoting the sale of their products through retail agencies.

To assist cooperatives in these problems the Division has continued its study of retail practices in the marketing of apples and other fruits in New York City. The information obtained to date is valuable to the cooperative associations because it indicates retailers' preferences with respect to quality, grade, and packaging, and also provides information regarding the quantities of apples and other fruits sold by various types of stores in various income areas.

The problem of choosing marketing methods to be followed and the types of outlets the cooperative should attempt to serve are also important. Various changes have occurred in the methods of selling, the agencies which perform the selling functions, and the agencies which buy fruits and vegetables in carlot quantities from cooperatives and other producers.

The Division has undertaken to obtain information with regard to marketing practices and methods used by fruit and vegetable cooperatives, the changes that have occurred in market outlets and methods

of sale during the last 10 years, and the effect of these changes on the progress made by the cooperatives. It is hoped that this study will assist in establishing standards that will guide associations in formulating their marketing policies.

A number of factors, such as pressure of fresh supplies and the popularity of fruit juices, have increased the quantities of canned fruits and vegetables and canned fruit and tomato juices coming on the market. Growers in many sections are becoming interested in establishing cooperative canning plants, principally because they see in such a plant another outlet for their supplies. This interest has persisted in spite of the fact that up until the latter part of 1939 conditions for all canners were decidedly unfavorable.

The Division is undertaking to secure more comprehensive information regarding the canning of fruits and vegetables, the experiences of cooperatives in the field, the investment and costs required to operate a successful canning plant cooperatively, and the returns which cooperative plants have made to their members over a 3-year period. Results of this study should serve as a guide to groups contemplating the organization of a cooperative cannery and in certain instances aid those now operating to make improvements.

During the year Florida citrus growers have requested the Division to assist them in developing a plan for coordinating the activities of cooperative associations and grower-shippers operating in the State. The growers, through their State-wide educational organization, have aroused the interest of established cooperative groups and large growers of oranges and grapefruit who do their own shipping. Although their plans have been temporarily halted by frost damage to the 1939–40 crop, they plan to continue the program, and there are definite indications that greater cooperative development will come from it.

Grain

For the crop year 1938–39, 2,540 grain marketing associations were reported operating in the United States. This is a decline of 79 associations from the number reported in 1937–38, and indicates continuance of the trend toward fewer but larger and stronger associations which has been in evidence for more than a decade. Continuation of drought conditions in the Great Plains wheat areas during 1938–39 put further pressure on weaker associations and forced a number of them into liquidation. A decrease in Corn Belt States is accounted for mainly by the passing into private hands of a number of farmers' stock companies with weak cooperative structures. Studies made by the Division indicate that the farmers' cooperative grain movement might benefit from absorption of weak associations

by stronger, better located organizations, with all members gaining from lower costs and more capable management.

Evidence that the trend toward fewer associations has not necessarily weakened the cooperative grain movement is given by the fact that the estimated membership of grain cooperatives was 367,000 in 1938–39, a gain of 7,000 over the preceding year. Dollar volume of sales in 1938–39 totaled $383,000,000 as compared with $475,000,000 in the preceding year. This substantial decrease in dollar volume can be accounted for by declining price levels. For example, the average price of wheat received by farmers, according to the Bureau of Agricultural Economics, was 55 cents for the 1938 crop as compared to 96 cents for the 1937 crop. Much of the corn handled by farmers' elevators in 1938–39 was loan corn handled for the account of the Commodity Credit Corporation and therefore does not show up in dollar sales. Consequently, the actual volume of grain handled by cooperatives in 1938–39 was probably a little larger than in the preceding year. It is estimated that between $75,000,000 and $80,000,000 of the dollar sales of cooperative grain associations in 1938–39 consisted of farm supplies or "side lines."

Because they were organized a good many years ago, many farmers' elevators have an antiquated organization structure. This problem received increasing attention during 1938–39. A number of State farmers' grain dealers associations and State extension marketing specialists, as well as the local associations themselves, have been directing much of their attention toward modernizing the cooperative form of the local organizations and emphasizing the need for active membership effort. The Division has directed attention to this problem by publishing Circular C–115, entitled "Organization Structure of Farmers' Elevators."

Competition continues to work in the direction of constantly narrower margins, which means that cooperatives must give increasing attention to lowering operating costs and improving the quality of service if they are to justify their place in the market. Studies made by the Division have indicated the significance of such factors as volume, effective utilization of labor and facilities, a well-informed membership, and the advantages of side lines and services. A study now in progress in Iowa is directed toward determination of the marketing functions performed by farmers' elevators in handling feed grain.

With the passing in 1937–38 of the national grain marketing organization begun in 1930, its place has been taken by a number of regional grain marketing associations which are now operating in most of the

important terminal markets of the country. Operating information—in a few cases, quite limited—was obtained from nearly all of these regionals for 1938–39. They handled approximately 100,000,000 bushels of grain at a total net gain of $850,000. All except one association reported net earnings. On a unit basis, these net earnings varied from 2 cents a bushel for a regional which provided its members a rather complete grain marketing service, down to a small fraction of a cent for one handling grain only on a brokerage and commission basis. Results of 1938–39 operations are encouraging to farmers interested in carrying the cooperative marketing of grain beyond local shipping points, and point the way to the kind of services which regional associations may perform to advantage.

History and Statistics

From the information collected by the Division it is estimated that there were 10,700 cooperative marketing and purchasing associations in active operation during the 1938–39 marketing season. Estimates of the number of associations, membership, and business transacted based on the data collected are given in the accompanying tables.

The information collected for the season 1938–39 together with data for previous years is being mimeographed as a miscellaneous report entitled "Statistics of Farmers' Marketing and Purchasing Cooperatives, 1938–39 Marketing Season."

Based on the information that has been accumulated over two decades, a study is being made of the reasons for the discontinuance of various farmers' cooperative enterprises. Records for 14,655 cooperative enterprises which have closed their doors at various times between 1871 and 1939 are being classified by the year they were organized, by the year their operations were discontinued, by the years in which they were active, by their type of organization, by the products they marketed or the supplies they purchased, and by their geographic location. The record of each association's performance is being examined and the environment in which each operated will be studied in an effort to obtain additional material that may indicate why it was desirable, or necessary, for the enterprise to cease functioning When this information is analyzed it should prove valuable to board. of directors, managers, and members of cooperatives in their efforts to determine policies that will avoid the mistakes of earlier organizations.

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Farmers' marketing and purchasing associations, by commodity groups, for the marketing seasons 1929–30 to 1938–39

Commodity group	Number of associations listed [1]									
	1929–30	1930–31	1931–32	1932–33	1933–34	1934–35	1935–36	1936–37 [2]	1937–38	1938–39
Marketing:										
Cotton and cotton products	199	261	267	274	250	305	311	401	415	476
Dairy products	2,458	2,391	2,392	2,293	2,286	2,300	2,270	2,338	2,421	2,373
Fruits and vegetables	1,384	1,386	1,347	1,268	1,194	1,082	1,063	1,104	1,164	1,116
Grain (including dry beans, rice)	3,448	3,448	3,500	3,131	3,178	3,125	3,010	2,614	2,619	2,540
Livestock	2,153	2,014	1,885	1,575	1,371	1,197	1,040	1,012	926	862
Nuts	44	71	70	65	57	53	52	49	52	46
Poultry and products	157	160	172	154	147	164	154	180	194	180
Tobacco	15	13	21	20	16	16	14	14	11	10
Wool and mohair	131	136	134	115	120	119	114	139	130	135
Miscellaneous products [3]	557	482	467	457	433	433	360	300	368	362
Total marketing	10,546	10,362	10,255	9,352	9,052	8,794	8,388	8,151	8,300	8,100
Purchasing	1,454	1,588	1,645	1,648	1,848	1,906	2,112	2,601	2,600	2,600
Total marketing and purchasing	12,000	11,950	11,900	11,000	10,900	10,700	10,500	10,752	10,900	10,700

[1] Includes independent local associations, federations, large-scale centralized associations, sales agencies, independent service-rendering associations, and subsidiaries whose businesses are distinct from those of the parent organizations.

[2] Estimates are based on data obtained by a door to-door survey of cooperatives conducted by the Farm Credit Administration in cooperation with the banks for cooperatives and the State agricultural colleges for 1936.

[3] Includes associations handling commodities not specified above, those handling several types of commodities, and those furnishing special services.

Estimated membership of farmers' marketing and purchasing associations, by commodity groups, for the marketing seasons 1929–30 to 1938–39

Commodity group	Estimated membership [1]									
	1929–30	1930–31	1931–32	1932–33	1933–34	1934–35	1935–36	1936–37 [2]	1937–38	1938–39
Marketing:										
Cotton and cotton products	150,000	190,000	240,000	200,000	200,000	255,000	300,000	341,800	350,000	315,000
Dairy products	650,000	725,000	740,000	724,000	757,000	750,000	720,000	656,900	700,000	650,000
Fruits and vegetables	218,000	182,000	180,000	170,000	185,000	158,000	166,000	141,700	164,000	168,000
Grain (including dry beans, rice)	810,000	775,000	705,000	600,000	600,000	580,000	610,000	362,900	360,000	367,000
Livestock	465,000	400,000	450,000	440,000	410,000	410,000	600,000	549,000	600,000	600,000
Nuts	14,000	17,000	18,000	17,500	15,000	14,800	16,000	13,300	15,800	15,000
Poultry and products	67,000	82,000	88,000	78,000	73,000	85,000	93,000	112,500	106,000	100,000
Tobacco	75,000	40,000	54,000	60,000	46,600	50,000	60,000	91,200	70,000	66,000
Wool and mohair	40,000	64,000	62,000	62,000	63,800	71,000	51,400	79,200	50,000	60,000
Miscellaneous products [3]	141,000	133,000	130,000	105,800	113,600	116,200	93,600	65,500	84,200	69,000
Total marketing	2,630,000	2,608,000	2,667,000	2,457,300	2,464,000	2,490,000	2,710,000	2,414,000	2,500,000	2,410,000
Purchasing	470,000	392,000	533,000	542,700	692,000	790,000	950,000	856,000	900,000	890,000
Total marketing and purchasing	3,100,000	[4] 3,000,000	[4] 3,200,000	3,000,000	3,156,000	3,280,000	[4] 3,660,000	3,270,000	3,400,000	3,300,000

[1] The membership estimates for the years since 1935 include members, contract members, and shareholders, but do not include patrons not in these categories.

[2] Estimates are based on data obtained by a door-to-door survey of cooperatives conducted by the Farm Credit Administration in cooperation with the banks for cooperatives and the State agricultural colleges for 1936.

[3] Includes associations handling commodities not specified above, those handling several types of commodities, and those furnishing special services.

[4] In the light of information received subsequent to the original publication of these data, the estimates have been revised.

Estimated business of farmers' marketing and purchasing associations, by commodity groups, for the marketing seasons 1929–30 to 1938–39

Commodity group	Estimated business in thousands of dollars [1]									
	1929–30	1930–31	1931–32	1932–33	1933–34	1934–35	1935–36	1936–37 [2]	1937–38	1938–39
Marketing:										
Cotton and cotton products	110,000	130,000	69,000	42,000	100,000	100,000	[3] 110,000	[3] 138,500	[3] 110,000	[3] 73,000
Dairy products	680,000	620,000	520,000	390,000	380,000	440,000	520,000	577,100	686,000	610,000
Fruits and vegetables	320,000	319,000	283,000	200,000	182,000	200,000	212,000	282,000	300,000	273,000
Grain (including dry beans, rice)	690,000	621,000	450,000	280,000	285,000	315,000	360,000	397,900	475,000	383,000
Livestock	320,000	300,000	260,000	182,000	162,000	175,000	250,000	320,600	312,000	280,000
Nuts	14,600	13,000	8,600	8,500	11,500	11,300	13,100	12,800	15,800	14,000
Poultry and products	79,400	86,000	72,000	53,000	48,000	53,000	69,000	72,000	91,000	78,000
Tobacco	6,800	7,000	10,000	6,500	5,500	7,500	11,500	14,400	13,000	11,000
Wool and mohair	10,800	26,000	21,000	9,000	13,700	15,700	11,000	11,500	11,300	13,000
Miscellaneous products [4]	78,400	63,000	50,400	28,500	25,300	25,500	29,400	55,800	35,900	30,000
Total marketing	2,310,000	2,185,000	1,744,000	1,199,500	1,213,000	1,343,000	1,586,000	1,882,600	2,050,000	1,765,000
Purchasing	190,000	215,000	181,000	140,500	152,000	187,000	[5] 254,000	313,400	[6] 350,000	[7] 335,000
Total marketing and purchasing	2,500,000	2,400,000	1,925,000	1,340,000	1,365,000	1,530,000	1,840,000	2,196,000	2,400,000	2,100,000

[1] Includes some intra-association transactions.

[2] Estimates are based on data obtained by a door-to-door survey of cooperatives conducted by the Farm Credit Administration in cooperation with the banks for cooperatives and the State agricultural colleges for 1936.

[3] Includes some Government-loan cotton.

[4] Includes associations handling commodities not specified above, those handling several types of commodities, and those furnishing special services.

[5] The purchasing business of the marketing associations is estimated at $68,000,000, and the marketing business of the purchasing associations, at $7,000,000. After adjustments the totals are: marketing, $1,525,000,000; purchasing, $315,000,000; total, $1,840,000,000.

[6] The purchasing business of the marketing associations is estimated at $117,000,000, and the marketing business of the purchasing associations, at $27,000,000. After adjustments the totals are: marketing, $1,960,000,000; purchasing, $440,000,000; total, $2,400,000,000.

[7] The purchasing business of the marketing associations is estimated at $107,000,000, and the marketing business of the purchasing associations, at $26,000,000. After adjustments the totals are: marketing, $1,684,000,000; purchasing, $416,000,000; total, $2,100,000,000.

Mutual Insurance

During the past year farmers' mutual insurance companies in several States gave special consideration to insuring against windstorm losses. Other developments included greater intercompany cooperation through State associations of farm mutuals, and their increased use of reinsurance.

Farm fire losses during 1939, as indicated by reports from selected farm mutuals which have a total of more than a billion dollars of insurance in force, were substantially heavier during 1939 than they were in 1938. The total United States fire losses on all classes of property also rose considerably above the total for 1938, but the relative increases in farm fire losses exceeded the percentage increase in the national fire losses. Severe droughts in many areas are believed to be one of the major causes of this increase in losses from fire. In these drought areas particularly, depreciated values of farm property, which in many instances make outstanding insurance excessive, have doubtless contributed to the indicated increase in losses by farm fires. This situation has emphasized the importance of careful and conservative appraisals of farm improvements as the basis for insurance, and the need in at least some instances of a program of special inspection and reappraisal of all outstanding risks.

Research in insurance during the year dealt primarily with reinsurance practices and facilities of farm mutuals, and with the problem of properly classifying and rating farm fire insurance risks. Special attention was also given to farmers' casualty insurance needs and the facilities available for meeting these needs.

Farm Credit Administration Circular E–15, entitled "Insuring Through Your Farmers' Mutual," was published during the year. It deals with cooperative insurance from the point of view of the individual farmer as a member or prospective member of a farm mutual. Earlier publications on this subject have approached farm-mutual problems largely from the point of view of the director or the manager of the insurance company.

Livestock and Wool

During the past year there have been a number of new developments in cooperative livestock marketing. The establishment of new sales agencies at Stockton, Calif., and Spokane, Wash., have increased the interest in cooperative livestock marketing on the Pacific coast. Several local hog pools operating in Southern Idaho joined together for the purpose of coordinating and concentrating the sale of their hogs through the Producers Livestock Marketing Association at Salt Lake City.

Some livestock cooperatives seem to be recognizing the trend toward the decentralization of livestock markets. To meet this trend, some terminal livestock sales agencies have established branches in their trade territory. In some instances these branches have been established near interior packing plants because it was felt that the association could provide an improved bargaining service to livestock producers. A study of livestock auctions which has recently been completed, brought out the fact that there are over 1,300 now operating in 37 States. From this study it appears that the auction method of marketing will probably continue as an important part of our livestock marketing structure. The auction appears to offer some features which appeal to farmers. These include the convenience of having a local cash market and a means of exchanging locally produced breeder and feeder livestock. The sale of livestock in pools on a graded basis was another favorable feature found at some auctions.

An appraisal of the operations of auctions, however, indicated certain inherent weaknesses which detract from their efficiency as marketing agencies. Some of these weaknesses include unsatisfactory and unethical selling, buying, and weighing practices; lack of buying competition; financial instability; danger of spreading disease; and lower prices resulting from decentralized selling.

To date cooperatives have played a minor role in the development of auctions, primarily because of the speculative risk involved and the feeling that auctions duplicate the established marketing machinery without offering sufficient improvements of existing marketing methods. The importance of the auctions in the principal livestock areas, however, is a matter which directly affects cooperatives and is one which they can no longer afford to overlook.

As a result of business analysis of the Producers Cooperative Commission Association at Cincinnati, Ohio, the Division recommended that the association, in common with other livestock cooperatives and private sales organizations, should work toward a program of selling and quoting livestock on the basis of recognized grades and weights.

The Division recommended that regularly scheduled sales meetings should be held prior to the opening of each day's market. These meetings should aim to strengthen the selling side of the market and on the basis of the best information available, they should give salesmen rather definite ideas as to what the market action should be for the day. The use of bills of lading for the handling of truck livestock was also suggested and the Division pointed out that the organization of local trucking units offered a worth-while opportunity for the association to build business volume and establish contacts with producer.

Cold-storage locker plants are increasing in numbers with the movement now expanding into Eastern and Southern States. It is estimated that over 2,000 are now in operation. Farmers in many sections are organizing their own cooperative locker associations. In order to assist groups of producers interested in forming such associations, a guide for organizing refrigerated food locker associations was prepared.

During 1939 there was increased use of four different methods of marketing wool. These methods were local country pool sales, country warehouse selling, the auction system, and sealed bid sales.

Cooperative wool marketing associations are attempting to meet these changing marketing conditions and to build up a system whereby they can take care of the grower who wants immediate payment in full when his clip is ready to market. Some of the associations who normally depend on consignments for their volume are adjusting their operations to this trend toward direct marketing by offering a direct selling service.

In order to assist cooperatives in these readjustments, a study is being made of wool marketing methods. Existing practices in selling wool will be appraised to determine their present effectiveness, their possibilities, their limitations, and which method or methods of sale seem to best meet the needs of growers and their cooperatives. Seven Western States and 16 fleece wool States are included in this study. The college and extension groups in each of these States are cooperating in the study.

Poultry and Eggs

During the past decade there has been a considerable shift in egg and poultry production in the United States. A large increase in production in the Northeastern States has been more or less offset by a decrease in the Western States. Partly as a result of this shift new problems have arisen in the cooperative marketing of eggs and poultry in both areas. The Cooperative Research and Service Division has assisted associations in both areas in solving some of these problems.

The increased importance of poultry production in the Northeast was accompanied by the formation or handling of poultry products by nearly 50 cooperative associations in the Northeastern States since 1930. About half of these associations are of the country-point auction type. The other half is comprised of 5 other types of associations marketing eggs and poultry. Studies have been made of all of these associations during the past 3 years. These studies indicated that, with the increase in their number, volumes of produce handled, and importance, there is a growing need for a closer affiliation or coordination of the activities of these associations. Such action has been suggested to these associations and plans for an overhead service

and coordinating organization are now being formulated at their request.

The decrease in egg production in the far West has caused a substantial decrease in the volume sold through the Eastern sales agencies of the large Western egg cooperative associations. This decrease in Eastern sales volume has lessened the utilization of the several separate sales agencies with an attendant increase in per-unit marketing costs in some instances. The Division is continuing to study the operations of the Eastern sales agencies of these associations to determine desirable changes in operating and selling methods and policies, the possibility of handling additional products, and the feasibility of a closer coordination or affiliation of the sales agencies concerned.

The growing interest on the part of a number of State colleges of the North Central States has resulted in the making of a study of the cooperative marketing of poultry products by these State colleges in cooperation with the Division. Most of the field work on this project has now been completed. The primary objective is to determine the type or types of associations best suited to the cooperative marketing of poultry and eggs under production and marketing conditions which prevail in North Central States where farm flocks are usually small and poultry raising is a side-line farm enterprise.

Purchasing

During 1939 cooperative associations purchasing farm supplies continued to make progress in improving their methods of organization and operation. While there was some decrease in the number of new associations formed, this was more than compensated for by the extension and widening of the services offered by existing associations. The rapid expansion of cooperative purchasing activity which has been going on during the past 5 years has apparently come to a close. At present the movement seems to be going through a stage of self-appraisal in which the emphasis is being placed more on internal improvements than extensive promotion.

This general change is evidenced by the attention which associations have given during the past year to the improvement of their business methods. For example, many associations have made great progress in controlling their methods of credit extension and collection, in improving the character of their management and operating personnel, in developing worth-while membership education programs, in refining their methods of accounting and budgeting, in revamping their financial programs to provide for greater financial stability, and in bringing up to date their methods of providing service.

During the year the associations have continued to widen the lines of supplies handled. Associations have been on the alert to find

additional supplies that could be handled without disrupting their programs of service. Generally, the supplies added have been of a farm supply character, but in some cases the associations have undertaken to provide service in selected household supplies. In this connection one large regional association which operates in Minnesota and Wisconsin has set up a chain of cooperative grocery stores under a subsidiary organization. The grocery stores are managed on an entirely separate basis from its member associations which confine their operations largely to petroleum and related supplies. On the other hand, some associations have found it desirable to reduce the number of supplies handled. For example, one large regional purchasing association in the East has recently ceased to handle electrical supplies and other supplies not directly required in the operation of a farm.

A large number of associations, both large and small, have made great improvements in their operating facilities during the year. One outstanding development has been the construction of a $750,000 petroleum refinery in Kansas. A somewhat smaller cooperative refinery unit is being established in Indiana. This is part of the cooperatives' trend toward reaching back to the sources of production in order to make greater savings for their members and to establish a more definite control over the quality of supplies handled. Along with the construction of the cooperative refineries, petroleum cooperatives have continued to give much attention to methods of reducing costs in transportation. The large associations are now generally employing transport trucks, and, in several cases, are using water terminals to achieve every possible transportation economy. The same trend toward more manufacturing in an attempt to go back nearer to the source of the raw materials is indicated by the establishment of a number of new cooperative feed mills and fertilizer mixing plants.

The process of integrating local and county associations into State and regional organizations has continued unabated. Both National Cooperatives, Inc., with offices in Chicago, and United Cooperatives, Inc., with offices in Indianapolis, which serve as large-scale bargaining associations for groups of regional cooperatives, have made satisfactory progress during the year. These large national organizations are doing much to standardize cooperative service through the use of trade-marks and controlling quality throughout the Nation.

A general study of retail credit costs and problems based on data from over two hundred farmers' purchasing associations in all parts of the United States is now under way and will be completed during 1940. These credit studies indicate that it is imperative for coopera-

tive purchasing associations to restrict the extension of credit to the minimum and to employ sound business methods in its control.

In order to provide more complete information on the retail distribution of petroleum products by farmers' cooperative associations, a special circular, No. C–113, entitled "Farmers' Retail Petroleum Associations," was published. This report, which is largely based on data gathered for the year 1936, indicated that the total value of petroleum supplies purchased cooperatively by farmers amounted to approximately $90,000,000 in 1936.

One of the best illustrations of the federated system of cooperative purchasing is found in Indiana where the Indiana Farm Bureau Cooperative Association brings together in a federation some 80 county purchasing associations. In order to provide general information on the operation of this federated system, as well as to provide suggestions for its improvement, a bulletin, No. 38, entitled "Cooperative Purchasing by Indiana Farmers," was published. It is believed that this study will prove of general interest to cooperative purchasing associations.

During the past few years there has been great interest in this country in the operation of cooperative purchasing associations in foreign lands. In view of this interest, a study was made of the cooperative purchasing of farmers' supplies in the British Isles. The results were published as Bulletin No. 31, entitled "Cooperative Farm Supply Purchasing in the British Isles." Farmers in the British Isles have their own system of farm supply purchasing associations which was started in 1870. In 1936 these associations sold almost $60,000,000 worth of farm supplies such as feed and fertilizer. This bulletin tells of the relations between the farmer-purchasing associations and the large consumer cooperative associations in these countries.

A large part of the service work of the section has consisted of sending information in response to specific requests. Many of these requests have asked for information on methods of setting up cooperative purchasing associations. Other requests have related to problems of accounting, quality, merchandising, methods of financing and credit control. In many cases these requests were answered by providing bulletins and similar material. In many instances, however, it was necessary to develop special information. This type of service is continuing to increase in importance.

Credit Union Section

Federal credit unions, enjoying another year of steady growth in 1939, have demonstrated that working people can solve many of their

thrift and credit problems cooperatively. Chartering of new credit unions has continued month after month and at the same time the enrollment of new members and extending of services to members has been accelerated.

Federal charters were granted to 529 credit unions during 1939, as compared with 515 in 1938, bringing the total number issued since the Federal act was passed in 1934 to 3,544.

The estimated membership at the end of the year was 860,000, assets were $47,500,000, shareholdings were $43,500,000, and outstanding loans were $38,500,000. These estimates are based on actual returns for the semiannual period ended June 30, 1939, which included reports from 2,974 active Federal credit unions and showed a combined membership for those reporting of 746,411, assets of $37,683,864, shareholdings of $34,600,460, and loans outstanding of $30,863,581.

As there were 3,006 active Federal credit unions on June 30, 1939, these figures represent returns from 99 percent of those actually doing business. They may be compared with the figures for June 30, 1938, which also represented 99 percent of the Federal credit unions active at that time. Such comparison shows an increase during the 12-month period of 32 percent in membership, 60 percent in assets, 60 percent in shareholdings, and 60 percent in loans outstanding. Total loans made since the first Federal credit union began operations on October 1, 1934, through June 30, 1939, amounted to more than $134,000,000 for those reporting at that time. Of this amount, representing 1,515,000 individual loans, approximately $103,072,000 had been repaid and $76,000, or six-hundredths of 1 percent, was charged off against the reserve for bad loans. Federal credit union loans continued to be principally small loans, the average being only $88. A recent study indicates that over 75 percent of all loans made were for less than $100. During the 12-month period from July 1, 1938, to June 30, 1939, 604,811 loans were made by the credit unions which sent in reports. These loans totaled $60,381,238. On the basis of these reports it is estimated that $75,000,000 was loaned by Federal credit unions during the calendar year 1939.

Continuous Growth

Over the last 5 years the expansion in size and in volume of business has continued in spite of fluctuations in economic and business conditions. While in general the rate of growth has been remarkably even, the 1939 rate of increase in membership, in use of credit services, and in average savings per member showed a notable acceleration. Increased business activity has no doubt contributed to this, as well as improved operating practices and more effective membership education.

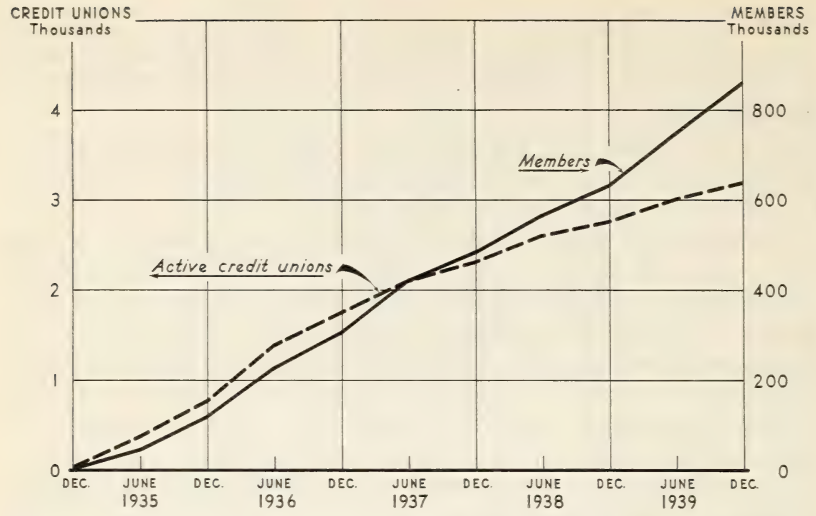


FIGURE 18.—ACTIVE FEDERAL CREDIT UNIONS AND THEIR MEMBERS

Organization of new Federal credit unions in 1939 continued to advance most noticeably in the eastern industrial States. In New York, 91 new organizations were started and 63 were started in Pennsylvania. These were the 2 leading States. Other States which showed substantial increases in new organizations were Ohio with 52 new Federal charters; Texas with 48; California with 39; Indiana, 29; New Jersey, 25; and Connecticut, 22.

Industrial Groups Gain

Industrial or business groups continued to represent the largest number of charters granted, accounting for 62 percent of the total number issued. Church, cooperative, labor union, fraternal, government, teacher, and residential groups accounted for 38 percent of all charters granted in 1939, as compared to 40 percent in 1938.

Management Training

Recognizing the importance of sound business operations, the Farm Credit Administration continued to emphasize the need of efficient management by Federal credit union officials. To this end the field staff has enlarged the scope of its instructions to treasurers, directors, credit committees, and supervisory committees, as well as employees of credit unions. These instructions are designed to help Federal credit union officials operate their credit unions so as to give the utmost service to members in an efficient manner. The results of this program are reflected in improved operations disclosed by the annual examina-

tions of Federal credit unions during 1939, and the increased volume of business transacted.

During the year the Credit Union Section's bimonthly bulletin, Cooperative Saving, served as a means of informing Federal credit unions as to operating practices, interpretations of the law and bylaws, and membership education.

Membership Education

During 1939 over 1,300 Federal credit unions reported the establishment of educational committees. Their function is to inform and help members obtain the most value from their credit unions. Many members are making use of the services of these committees to assist them in planning their family finances and adopting and following systematic saving, borrowing, and spending plans.

General Policies

Careful and thorough investigation is made of groups applying for charters, to determine the economic advisability, the needs of the group, the qualifications of members to successfully operate a Federal credit union, and the genuine interest of a sufficient number within the group to assure it a reasonable chance of success. Upon approval of a charter, the group is thoroughly instructed and assisted in starting operations on a sound basis. Membership education and participation is encouraged from the beginning. It is the purpose of the Farm

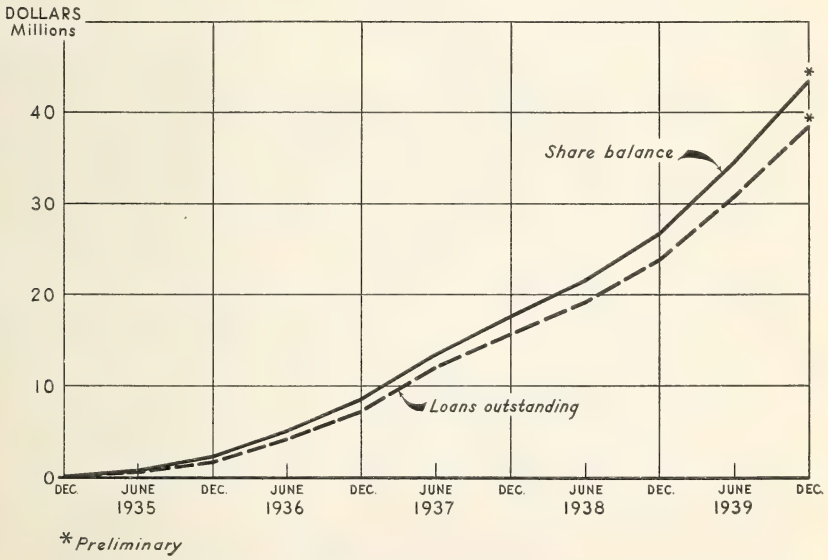


FIGURE 19.—FEDERAL CREDIT UNION SHARE BALANCES AND LOANS OUTSTANDING

Credit Administration to shape its policies so as to assist Federal credit unions to maintain their operations on a sound basis so they may be of utmost service to their members.

Publications Available from the Farm Credit Administration

The circulars and bulletins on farm credit and related subjects listed below are some of the publications which are available from the Director of Information and Extension, Farm Credit Administration, Washington, D. C.

Farm Mortgage Credit

Federal Land Bank and Land Bank Commissioner Loans, Circular 1.
Appraising Farms for Mortgage Loans, Circular 13.
Selecting and Financing a Farm, Circular 14.
The Gateway to Farm Ownership, Circular B–3.
The Credit Road to Farm Ownership, Circular 18.

Production Credit

Financing the Farm Business, Circular C.
Loans by Production Credit Associations, Circular 3.
Short-term Credit—A Good Farm Tool, Circular 21.
Using Your Production Credit Association, Circular E–17.

Farmers' Cooperative Associations

Loans to Farmers' Cooperatives, Circular 6.
Using Your Co-op Creamery, Circular E–6.
Using Your Livestock Co-op, Circular E–7.
Using Your Co-op Elevator, Circular E–8.
Using Your Co-op Gin, Circular E–9.
Using Your Wool Co-op, Circular E–10.
Using Your Purchasing Association, Circular E–11.
Using Your Fruit and Vegetable Co-op, Circular E–12.
Using Your Poultry and Egg Co-op, Circular E–13.
Using Your Fluid Milk Co-op, Circular E–14.
Insuring Through Your Farmers' Mutual, Circular E–15.
Sizing Up Your Cooperative, Circular E–18.
Forming Farmers' Cooperatives, Circular E–19.
Financing Farmers' Cooperatives, Circular E–20.
Managing Farmers' Cooperatives, Circular E–21.
Merchandising by Farmers' Cooperatives, Circular E–22.
The Story of Farmers' Cooperatives, Circular E–23.
The Farmers' Cooperative Yardstick, Circular 17.
Refrigerated Food Lockers, A New Cooperative Service, Circular C–107.
Organizing a Farmers' Cooperative, Circular C–108.
Marketing Fruits and Vegetables Cooperatively, Circular C–110.
Co-ops in Agriculture, Circular C–111.
Farmers' Retail Petroleum Associations, Circular C–113.
Cooperative Marketing of Dairy Products, Circular C–116.
Cooperative Purchasing of Farm Supplies, Bulletin 1.

Cooperative Marketing of Agricultural Products, Bulletin 3.
Membership Relations of Cooperative Associations, Bulletin 9.
A Statistical Handbook of Farmers' Cooperatives, Bulletin 26.
Cooperative Farm Supply Purchasing in the British Isles, Bulletin 31.
Cooperative Marketing of Fleece Wool, Bulletin 33.
Livestock Auction Markets in the United States, Bulletin 35.
Cooperative Egg and Poultry Auction Associations, Bulletin 37.
Cooperative Creamery Accounting, Bulletin 39.
News for Farmer Cooperatives. Issued monthly.

Credit Unions

Federal Credit Unions—Cooperative Thrift and Credit, Circular Eye.
Federal Credit Unions, Circular 10.
Suggestions for Educational Committees of Federal Credit Unions, Circular 23.
Cooperative Saving with Federal Credit Unions. Issued bimonthly.

General and Miscellaneous

A List of Publications of the Farm Credit Administration, Circular A–17.
Agricultural Financing Through the Farm Credit Administration, Circular 5.
The Profitable Use of Farm Credit, Circular E–4.
The Federal Intermediate Credit Banks, Circular 7.
Federal Farm Mortgage Corporation Bonds, Circular 8.
ABC's of Credit for the Farm Family, Circular 15.
Agricultural Credit in Germany, CR–1.
Using Credit Instruments, Circular 16.
Farm Credit Quarterly. (Issued 4 times a year.)

Appendix

Details regarding the operations of all organizations under the jurisdiction of the Farm Credit Administration are given in tabular form in the appendix to this report. Most of these statistics, as well as the statistical data which appear in the text of the report, were compiled from reports submitted to the Farm Credit Administration by the various institutions.

FEDERAL LAND BANKS AND LAND BANK COMMISSIONER

TABLE 1.—*Applications received, loans closed, and loans outstanding 1933–39*

Year	Applications received		Loans closed		Loans outstanding, Dec. 31	
	Number	Amount	Number	Amount	Number	Amount
1933	[1] 502,470	[1] $2,064,897,403	[1] 79,339	[1] $210,950,776	472,855	$1,303,445,263
1934	402,829	2,043,653,392	496,501	1,283,503,456	953,643	2,532,616,762
1935	162,968	811,081,485	149,972	445,066,549	1,075,008	2,866,651,139
1936	84,030	375,504,853	65,291	186,427,995	1,094,910	2,900,936,491
1937	60,836	247,985,002	37,862	103,111,902	1,091,067	2,848,056,032
1938	58,719	231,940,745	31,624	80,813,617	1,076,861	2,735,074,803
1939	49,917	199,793,979	30,047	78,998,850	1,057,532	2,595,534,825

[1] May 1, 1933, through Dec. 31, 1933

TABLE 2.—*Applications received and loans closed during 1939, and loans outstanding Dec. 31, 1939, by States*

District and State	Applications received during 1939		Loans closed during 1939		Loans outstanding, Dec. 31, 1939	
	Number	Amount	Number	Amount	Number	Amount
District 1:						
Maine	251	$643,000	52	$93,500	5,298	$10,020,356
New Hampshire	127	375,800	66	110,500	1,268	2,087,196
Vermont	237	869,200	132	227,400	3,302	6,081,933
Massachusetts	308	1,140,400	237	506,500	5,330	10,991,082
Rhode Island	56	180,300	43	94,200	791	1,808,246
Connecticut	372	1,734,800	341	837,400	4,281	9,497,797
New York	1,784	6,307,900	1,135	2,519,800	22,315	48,981,535
New Jersey	561	2,544,500	379	866,600	5,572	13,677,099
Total	3,696	13,795,900	2,385	5,255,900	48,157	103,145,244
District 2:						
Pennsylvania	867	3,342,600	363	790,400	14,524	26,588,060
Delaware	52	208,100	23	38,700	587	1,242,451
Maryland	276	1,551,300	133	326,600	4,248	11,248,205
Virginia	689	2,501,750	301	664,800	15,971	33,081,956
West Virginia	358	1,167,400	134	298,000	7,168	10,467,314
Puerto Rico	194	1,042,760	76	307,400	4,365	11,634,168
Total	2,436	9,813,910	1,030	2,425,900	46,863	94,262,154

FEDERAL LAND BANKS AND LAND BANK COMMISSIONER

TABLE 2.—*Applications received and loans closed during 1939, and loans outstanding Dec. 31, 1939, by States*—Continued

District and State	Applications received during 1939		Loans closed during 1939		Loans outstanding, Dec. 31, 1939	
	Number	Amount	Number	Amount	Number	Amount
District 3:						
North Carolina	1,792	$4,527,145	951	$1,482,640	25,015	$33,626,685
South Carolina	908	2,300,800	413	682,480	15,874	23,627,481
Georgia	2,179	5,470,889	1,087	1,539,249	27,386	37,590,228
Florida	662	2,607,270	257	718,550	9,773	17,010,811
Total	5,541	14,906,104	2,708	4,422,919	78,048	111,855,205
District 4:						
Ohio	1,759	6,420,300	1,108	2,589,100	32,448	72,927,552
Indiana	2,101	6,731,900	1,265	2,651,300	40,994	88,940,565
Kentucky	1,071	3,306,200	539	1,339,900	23,181	47,334,480
Tennessee	1,400	3,508,200	751	1,283,300	24,559	40,577,542
Total	6,331	19,966,600	3,663	7,863,600	121,182	249,780,139
District 5:						
Alabama	2,410	4,570,350	1,518	1,960,300	31,130	35,934,960
Mississippi	1,550	4,178,385	770	1,798,131	27,641	33,887,811
Louisiana	680	2,329,500	424	1,089,800	15,164	24,166,286
Total	4,640	11,078,235	2,712	4,848,231	73,935	93,989,057
District 6:						
Illinois	2,369	14,746,600	1,929	8,146,800	41,303	174,920,084
Missouri	1,252	3,697,700	602	1,298,300	27,628	57,234,433
Arkansas	738	1,865,400	283	675,500	17,035	23,387,625
Total	4,359	20,309,700	2,814	10,120,600	85,966	255,542,142
District 7:						
Michigan	972	3,101,000	505	1,019,800	40,780	69,947,521
Wisconsin	768	4,087,600	405	1,090,500	46,159	117,851,063
Minnesota	1,082	5,788,000	664	2,105,200	52,322	154,140,834
North Dakota					35,718	88,616,881
Total	2,822	12,976,600	1,574	4,215,500	174,979	430,556,299
District 8:						
Iowa	2,178	15,765,400	1,804	7,834,800	54,509	254,227,638
South Dakota	348	1,357,200	192	534,300	24,140	68,130,195
Nebraska	1,686	7,870,100	1,281	3,896,800	40,309	147,577,815
Wyoming	291	1,701,600	186	626,900	5,903	13,760,736
Total	4,503	26,694,300	3,463	12,892,800	124,861	483,696,384
District 9:						
Kansas	2,244	9,308,800	1,501	3,601,700	46,683	127,351,677
Oklahoma	1,718	5,080,100	836	1,665,400	27,195	50,188,363
Colorado	1,135	5,122,900	553	1,324,000	15,702	35,371,465
New Mexico	409	1,815,200	216	500,200	6,571	11,578,209
Total	5,506	21,327,000	3,106	7,091,300	96,151	224,489,714
District 10: Texas	4,355	15,508,200	3,011	7,433,150	99,455	240,658,648

FEDERAL LAND BANKS AND LAND BANK COMMISSIONER

TABLE 2.—*Applications received and loans closed during 1939, and loans outstanding Dec. 31, 1939, by States*—Continued

District and State	Applications received during 1939		Loans closed during 1939		Loans outstanding, Dec. 31, 1939	
	Number	Amount	Number	Amount	Number	Amount
District 11:						
Arizona	183	$1,183,100	184	$674,000	3,235	$10,483,443
Utah	127	576,300	64	212,100	8,992	19,732,497
Nevada	33	272,000	10	34,600	703	3,682,314
California	2,049	15,091,200	1,310	5,424,500	38,071	135,227,930
Total	2,392	17,122,600	1,568	6,345,200	51,001	169,126,184
District 12:						
Montana	718	3,011,120	367	887,650	11,383	26,951,762
Idaho	919	3,878,450	570	1,417,750	14,395	35,456,867
Washington	867	4,689,050	538	1,993,350	17,605	39,895,904
Oregon	832	4,716,210	538	1,785,000	13,551	36,129,122
Total	3,336	16,294,830	2,013	6,083,750	56,934	138,433,655
Grand total	49,917	199,793,979	30,047	78,998,850	1,057,532	2,595,534,825

TABLE 3.—*Applications received and loans closed during 1939, by quarters*

Quarter	Applications received		Loans closed					
			Federal land banks		Land Bank Commissioner		Total	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount
First quarter	12,537	$52,075,089	4,041	$15,183,400	5,012	$8,264,944	9,053	$23,448,344
Second quarter	10,541	43,195,205	3,579	13,445,400	4,275	7,207,700	7,854	20,653,100
Third quarter	12,062	48,057,550	2,731	10,359,300	3,179	5,399,550	5,910	15,758,850
Fourth quarter	14,777	56,466,135	3,273	12,593,400	3,957	6,545,156	7,230	19,138,556
Total	49,917	199,793,979	13,624	51,581,500	16,423	27,417,350	30,047	78,998,850

FEDERAL LAND BANKS AND LAND BANK COMMISSIONER

TABLE 4.—*Percentage of loan proceeds used for various purposes during 1939, by States*

District and State	Federal land bank loans					Land Bank Commissioner loans			
	Refinancing indebtedness [1]	Purchase of land and redemption from foreclosure	General agricultural uses, including buildings and improvements	National farm loan association stock [2]	Loan fees	Refinancing indebtedness [3]	Purchase of land and redemption from foreclosure	General agricultural uses, including buildings and improvements	Loan fees
District 1:									
Maine	71.0	20.9	2.3	4.9	.9	83.1	8.1	8.4	.4
New Hampshire	60.5	28.9	4.8	5.0	.8	63.1	25.4	11.2	.3
Vermont	60.7	21.6	11.8	5.0	.9	67.0	21.0	11.6	.4
Massachusetts	64.8	19.9	9.4	5.0	.9	60.5	24.2	15.0	.3
Rhode Island	57.8	29.9	6.4	5.0	.9	69.0	20.3	10.4	.3
Connecticut	69.0	11.4	13.7	5.0	.9	66.4	5.0	28.3	.3
New York	64.6	21.3	8.2	5.0	.9	65.7	18.1	15.9	.3
New Jersey	67.7	18.6	7.8	5.0	.9	69.2	15.7	14.8	.3
Total	65.5	19.6	9.0	5.0	.9	66.3	16.4	17.0	.3
District 2:									
Pennsylvania	63.9	25.5	4.3	4.9	1.4	65.4	28.0	5.9	.7
Delaware	59.0	33.5	1.1	5.0	1.4	55.0	25.6	18.6	.8
Maryland	59.2	29.0	5.4	5.0	1.4	62.5	30.6	6.2	.7
Virginia	74.7	14.8	4.2	4.9	1.4	73.4	18.9	6.9	.8
West Virginia	73.2	11.7	8.7	5.0	1.4	76.0	13.8	9.5	.7
Total [4]	67.8	20.8	5.0	5.0	1.4	68.7	23.4	7.1	.8
District 3:									
North Carolina	74.5	8.2	10.2	5.0	2.1	79.0	9.7	9.8	1.5
South Carolina	64.9	16.0	12.1	5.0	2.0	65.3	20.4	12.6	1.7
Georgia	71.4	8.9	12.5	5.0	2.2	74.3	12.9	10.9	1.9
Florida	83.8	4.7	5.7	5.0	.8	79.3	9.1	10.4	1.2
Total	74.1	8.8	10.3	5.0	1.8	75.1	12.6	10.7	1.6
District 4:									
Ohio	67.4	23.3	3.2	5.0	1.1	67.2	26.9	5.4	.5
Indiana	60.6	29.8	3.5	5.0	1.1	59.6	33.0	6.9	.5
Kentucky	74.2	17.3	2.4	5.0	1.1	73.6	19.2	6.7	.5
Tennessee	77.3	12.9	3.7	5.0	1.1	80.2	11.8	7.4	.6
Total	67.6	23.1	3.2	5.0	1.1	68.6	24.3	6.6	.5
District 5:									
Alabama	76.5	11.0	6.9	5.0	.6	75.1	13.7	9.8	1.4
Mississippi	83.8	5.6	5.2	5.0	.4	79.0	9.9	9.9	1.2
Louisiana	81.9	6.2	6.5	5.0	.4	81.5	6.5	11.0	1.0
Total	80.6	7.8	6.1	5.0	.5	77.8	10.8	10.1	1.3
District 6:									
Illinois	55.6	33.6	4.1	5.0	1.7	58.5	37.9	2.9	.7
Missouri	71.2	18.4	2.9	5.0	2.5	72.9	23.5	2.4	1.2
Arkansas	71.2	16.2	5.7	5.0	1.9	76.1	15.3	7.0	1.6
Total	58.3	30.9	4.0	5.0	1.8	62.6	33.4	3.2	.8

See footnotes at end of table.

FEDERAL LAND BANKS AND LAND BANK COMMISSIONER

TABLE 4.—*Percentage of loan proceeds used for various purposes during 1939, by States*—Continued

District and State	Federal land bank loan				Land Bank Commissioner loans				
	Refinancing indebtedness [1]	Purchase of land and redemption from foreclosure	General agricultural uses, including buildings and improvements	National farm loan association stock [2]	Loan fees	Refinancing indebtedness [3]	Purchase of land and redemption from foreclosure	General agricultural uses, including buildings and improvements	Loan fees
District 7:									
Michigan	52.1	38.3	4.0	5.0	.6	56.5	31.7	11.1	.7
Wisconsin	73.8	17.7	3.1	4.9	.5	68.3	23.2	8.2	.3
Minnesota	53.7	38.4	2.4	5.0	.5	51.6	39.4	8.6	.4
North Dakota	-------	-------	-------	-------	-------	-------	-------	-------	-------
Total	58.6	33.0	2.9	5.0	.5	57.3	33.0	9.2	.5
District 8:									
Iowa	57.4	36.0	.9	5.0	.7	58.7	39.1	1.9	.3
South Dakota	58.6	33.8	2.2	5.0	.4	68.8	27.8	3.2	.2
Nebraska	71.4	21.9	1.0	5.0	.7	73.6	25.1	1.1	.2
Wyoming	80.6	11.5	2.3	5.0	.6	73.8	24.0	2.0	.2
Total	62.5	30.8	1.0	5.0	.7	65.2	32.9	1.7	.2
District 9:									
Kansas	74.3	15.6	4.1	5.0	1.0	77.7	20.2	1.6	.5
Oklahoma	68.4	22.3	3.2	5.0	1.1	74.0	22.6	2.7	.7
Colorado	74.7	16.2	2.8	5.0	1.3	78.4	18.5	2.3	.8
New Mexico	60.0	26.8	7.1	5.0	1.1	73.9	19.4	5.7	1.0
Total	72.1	17.9	3.9	5.0	1.1	76.6	20.3	2.4	.7
District 10: Texas	60.4	31.1	3.5	4.9	.1	58.4	36.2	5.2	.2
District 11:									
Arizona	76.5	13.5	2.1	5.0	2.9	79.8	16.4	3.0	.8
Utah	88.9	4.2	.3	4.9	1.7	82.1	15.4	1.5	1.0
Nevada	75.0	12.8	3.9	5.0	3.3	46.1	53.9	-------	-------
California	73.0	13.7	6.1	5.0	2.2	73.9	14.1	11.2	.8
Total	73.9	13.3	5.6	5.0	2.2	74.8	14.6	9.8	.8
District 12:									
Montana	85.7	6.9	2.2	5.0	.2	88.0	8.4	2.9	.7
Idaho	85.6	7.4	1.7	5.0	.3	88.0	9.1	2.1	.8
Washington	81.7	10.7	2.4	5.0	.2	85.0	11.7	2.7	.6
Oregon	83.4	10.5	.9	5.0	.2	85.5	10.9	2.9	.7
Total	83.6	9.4	1.8	5.0	.2	86.4	10.2	2.7	.7
Grand total [4]	67.3	22.7	4.0	5.0	1.0	69.5	23.3	6.6	.6

[1] For per centages of Federal land bank loan proceeds used to refinance debts, by type of indebtedness and class of creditor, see appendix table 7.

[2] Includes stock in Federal land banks subscribed by direct borrowers (including interim borrowers).

[3] For per centage of Land Bank Commissioner loan proceeds used to refinance debts, by type of indebtedness and class of creditor, see appendix table 53.

[4] Excluding Puerto Rico.

FEDERAL LAND BANKS

TABLE 5.—*Loans closed and outstanding, 1917–39*

Year	Loans closed		Loans outstanding, Dec. 31	
	Number	Amount	Number	Amount
1917	18,154	$39,112,115	(1)	(1)
1918	49,808	118,129,836	(1)	$156,213,892
1919	45,436	144,987,180	(1)	293,595,395
1920	17,997	66,984,534	126,179	349,678,988
1921	27,153	91,029,976	151,823	432,523,141
1922	74,055	224,301,400	221,778	639,486,435
1923	60,100	192,083,015	274,507	799,596,835
1924	47,227	165,509,845	313,712	927,567,598
1925	39,905	127,355,451	342,804	1,005,684,817
1926	36,893	131,317,715	366,494	1,077,818,724
1927	39,268	140,384,200	392,148	1,155,643,871
1928	26,988	102,236,400	404,865	1,194,820,881
1929	17,132	64,252,500	409,559	1,198,513,917
1930	12,572	47,971,000	410,493	1,189,604,354
1931	10,898	42,015,300	407,852	1,167,898,205
1932	7,208	27,569,800	400,537	1,128,564,461
1933	38,568	151,634,111	428,861	1,232,706,802
1934	190,147	730,367,140	606,344	1,915,791,654
1935	58,968	248,671,200	643,803	2,071,924,721
1936	26,362	109,170,200	639,828	2,064,157,944
1937	15,989	63,091,729	635,776	2,035,306,748
1938	14,171	51,418,472	628,781	1,982,224,007
1939	13,624	51,581,500	618,456	1,904,655,014
Total	888,623	3,131,174,619		

[1] Not available.

TABLE 6.—*Loans closed during 1939 and outstanding Dec. 31, 1939, by States*

District and State	Loans closed during 1939		Loans outstanding Dec 31, 1939	
	Number	Amount	Number	Amount
District 1:				
Maine	17	$45,500	3,148	$6,487,555
New Hampshire	27	54,600	750	1,336,323
Vermont	67	141,000	2,130	4,640,916
Massachusetts	96	223,200	3,693	7,094,032
Rhode Island	20	49,000	470	1,208,946
Connecticut	154	469,100	2,592	6,496,124
New York	557	1,593,600	14,268	35,996,592
New Jersey	169	452,100	3,116	9,093,460
Total	1,107	3,028,100	29,567	72,353,948
District 2:				
Pennsylvania	186	551,200	9,199	19,680,892
Delaware	8	19,800	314	830,251
Maryland	63	219,800	2,349	7,945,890
Virginia	154	457,600	11,168	26,629,645
West Virginia	62	196,400	4,623	7,881,134
Puerto Rico	18	120,500	3,747	10,091,701
Total	491	1,565,300	31,400	73,059,5113
District 3:				
North Carolina	318	694,400	12,068	18,816,323
South Carolina	134	328,800	6,863	13,409,786
Georgia	336	696,100	12,753	22,255,927
Florida	91	474,700	4,488	9,417,811
Total	879	2,194,000	36,172	63,899,847

FEDERAL LAND BANKS

TABLE 6.—*Loans closed during 1939 and outstanding Dec. 31, 1939, by States*—Continued

District and State	Loans closed during 1939		Loans outstanding Dec 31, 1939	
	Number	Amount	Number	Amount
District 4:				
Ohio	596	$1, 791, 300	19, 144	$53, 842, 672
Indiana	581	1, 633, 000	25, 496	68, 136, 790
Kentucky	232	836, 000	12, 735	33, 875, 157
Tennessee	257	620, 000	13, 872	28, 696, 970
Total	1, 666	4, 880, 300	71, 247	184, 551, 589
District 5:				
Alabama	654	1, 256. 200	20, 155	27, 691, 715
Mississippi	281	1, 259, 900	16, 885	26, 280, 155
Louisiana	173	736, 900	10, 432	19, 689, 449
Total	1, 108	3, 253, 000	47, 472	73, 661, 319
District 6:				
Illinois	1, 055	6, 050, 100	24, 822	137, 595, 459
Missouri	285	842, 600	14, 215	38, 742, 997
Arkansas	100	400, 900	10, 463	16, 956, 623
Total	1, 440	7, 293, 600	49, 500	193, 295, 079
District 7:				
Michigan	222	642, 300	22, 337	48, 025, 573
Wisconsin	197	765, 400	23, 500	74, 963, 857
Minnesota	330	1, 531, 700	29, 017	111, 779, 858
North Dakota			18, 679	60, 753, 448
Total	749	2, 939, 400	93, 533	295, 522, 736
District 8:				
Iowa	959	5, 813, 300	33, 302	201, 586, 590
South Dakota	70	269, 500	13, 556	49, 579, 204
Nebraska	662	2, 745, 100	24, 738	114, 856, 633
Wyoming	69	350, 100	3, 074	9, 475, 886
Total	1, 760	9, 178, 000	74, 670	375, 498, 313
District 9:				
Kansas	806	2, 620, 000	26, 508	90, 316, 703
Oklahoma	405	1, 124, 000	14, 481	34, 701, 614
Colorado	234	792, 200	9, 432	25, 699, 057
New Mexico	87	285, 100	4, 592	8, 801, 991
Total	1, 532	4, 821, 300	55, 013	159, 519, 365
District 10: Texas	1, 318	4, 636, 500	67, 819	194, 562, 987
District 11:				
Arizona	82	378, 100	2, 082	8, 159, 855
Utah	29	139, 900	5, 581	14, 455, 111
Nevada	6	20, 300	433	2, 977, 057
California	565	3, 482, 200	18, 361	91, 459, 883
Total	682	4, 020, 500	26, 457	117, 051, 906
District 12:				
Montana	138	461, 000	5, 912	16, 711, 914
Idaho	263	885, 000	9, 196	26, 654, 318
Washington	246	1, 285, 600	12, 132	31, 370, 478
Oregon	245	1, 139, 900	8, 366	26, 941, 702
Total	892	3, 771, 500	35, 606	101, 678, 412
Grand total	13, 624	51, 581, 500	618, 456	1, 904, 655, 014

FEDERAL LAND BANKS

TABLE 7.—*Percentage of loan proceeds used to refinance indebtedness during 1939, classified according to type of indebtedness and class of creditor, by States*[1]

District and State	First and junior mortgages held by—				Other indebtedness owed to—			Total
	Life insurance companies	Commercial banks	Joint stock land banks	Others	Commercial banks	Tax authorities	Other creditors	
District 1:								
Maine	----	19.5	----	33.7	1.1	4.1	12.6	71.0
New Hampshire	----	28.3	----	23.9	----	2.0	6.3	60.5
Vermont	----	22.0	----	29.8	2.0	.9	6.0	60.7
Massachusetts	----	14.9	----	26.9	1.4	4.4	17.2	64.8
Rhode Island	----	8.2	----	36.2	4.6	.9	7.9	57.8
Connecticut	----	14.8	----	37.6	1.0	2.5	13.1	69.0
New York	----	9.5	1.9	37.6	1.2	1.1	13.3	64.6
New Jersey	----	6.8	.4	44.9	3.0	5.4	7.2	67.7
Total	----	11.3	1.1	37.2	1.5	2.3	12.1	65.5
District 2:								
Pennsylvania	----	15.5	3.7	30.7	6.2	1.0	6.8	63.9
Delaware	----	19.0	----	36.1	----	.1	3.8	59.0
Maryland	1.7	9.9	1.0	34.5	4.9	.7	6.5	59.2
Virginia	4.2	18.2	2.7	37.5	4.6	.6	6.9	74.7
West Virginia	----	16.3	11.2	30.7	8.7	(3)	6.3	73.2
Total [2]	1.6	15.7	3.9	33.5	5.7	.7	6.7	67.8
District 3:								
North Carolina	7.5	10.1	11.3	32.4	2.3	4.1	6.8	74.5
South Carolina	10.1	5.5	8.6	30.8	.9	3.9	5.1	64.9
Georgia	11.7	13.9	5.7	32.9	1.3	2.8	3.1	71.4
Florida	----	14.0	----	48.8	5.6	1.7	13.7	83.8
Total	7.6	11.5	6.7	35.8	2.5	3.1	6.9	74.1
District 4:								
Ohio	9.7	13.8	2.3	21.9	10.8	.5	8.4	67.4
Indiana	9.4	12.5	4.3	20.8	6.3	.4	6.9	60.6
Kentucky	7.7	21.6	2.9	26.9	9.0	.2	5.9	74.2
Tennessee	13.0	16.4	----	30.5	8.0	2.0	7.4	77.3
Total	9.7	15.0	2.8	23.4	8.7	.6	7.4	67.6
District 5:								
Alabama	8.4	8.1	2.6	48.2	3.6	.3	5.3	76.5
Mississippi	21.8	13.8	4.1	39.8	.3	.3	3.7	83.8
Louisiana	11.4	15.9	2.9	44.4	3.7	.2	3.4	81.9
Total	14.3	12.1	3.2	44.1	2.4	.3	4.2	80.6
District 6:								
Illinois	9.4	5.3	2.0	27.5	4.1	.4	6.9	55.6
Missouri	12.3	10.1	3.9	32.7	5.7	.4	6.1	71.2
Arkansas	5.4	5.7	11.3	45.3	.5	1.5	1.5	71.2
Total	9.5	5.9	2.8	29.1	4.1	.4	6.5	58.3

See footnotes at end of table.

FEDERAL LAND BANKS

TABLE 7.—*Percentage of loan proceeds used to refinance indebtedness during 1939, classified according to type of indebtedness and class of creditor, by States* [1]—Continued

District and State	First and junior mortgages held by—				Other indebtedness owed to—			Total
	Life insurance companies	Commercial banks	Joint stock land banks	Others	Commercial banks	Tax authorities	Other creditors	
District 7:								
Michigan	2.6	10.9	1.0	28.0	1.8	.8	7.0	52.1
Wisconsin	3.1	8.0	----	54.7	1.3	.8	5.9	73.8
Minnesota	9.8	6.1	.2	27.9	2.3	.8	6.6	53.7
North Dakota	----	----	----	----	----	----	----	----
Total	6.5	7.7	.3	34.9	1.9	.8	6.5	58.6
District 8:								
Iowa	13.9	6.5	1.3	25.7	3.5	[3]	6.5	57.4
South Dakota	9.6	.5	1.8	29.3	3.4	1.2	12.8	58.6
Nebraska	6.7	7.3	1.9	31.0	10.1	1.5	12.9	71.4
Wyoming	----	8.5	6.0	37.9	4.5	2.7	21.0	80.6
Total	11.1	6.6	1.7	27.9	5.5	.6	9.1	62.5
District 9:								
Kansas	13.3	12.1	2.0	26.5	10.6	1.5	8.3	74.3
Oklahoma	14.8	5.1	1.4	33.8	6.4	1.2	5.7	68.4
Colorado	5.3	11.8	6.4	37.8	4.7	2.3	6.4	74.7
New Mexico	1.0	6.8	----	32.9	13.9	.3	5.1	60.0
Total	11.6	10.1	2.5	30.4	8.8	1.5	7.2	72.1
District 10: Texas	14.7	6.0	5.8	24.2	4.4	1.2	4.1	60.4
District 11:								
Arizona	5.2	20.8	----	38.5	.5	4.8	6.7	76.5
Utah	16.6	20.9	----	41.1	7.1	.6	2.6	88.9
Nevada	----	34.4	----	39.5	----	1.1	----	75.0
California	2.1	13.1	----	46.2	7.7	.8	3.1	73.0
Total	2.9	14.2	----	45.4	6.9	1.1	3.4	73.9
District 12:								
Montana	2.4	15.6	4.6	38.5	9.2	4.5	10.9	85.7
Idaho	6.5	12.2	.4	46.2	5.5	4.1	10.7	85.6
Washington	16.0	7.8	1.0	38.6	6.1	2.6	9.6	81.7
Oregon	10.2	7.9	5.9	36.3	5.5	5.4	12.2	83.4
Total	10.3	9.8	2.8	39.7	6.2	4.0	10.8	83.6
Grand total [2]	9.3	9.6	2.6	32.2	5.2	1.2	7.2	67.3

[1] For same information on Land Bank Commissioner loans, see table 53. For percentage of loan proceeds used for all purposes, including refinancing, see table 4.

[2] Excluding Puerto Rico.

[3] Less than 0.1 percent.

FEDERAL LAND BANKS

TABLE 8.—*Collection and other disposition of matured items due from borrowers during 1939, by banks*

Federal Land Bank of—	Total delinquent installments, advances, etc., Jan. 1, 1939	Total maturities and advances during 1939	Total amount collectible	Disposition				Percent delinquent, Dec. 31, 1939
				Percent collected	Percent extended or deferred	Percent reamortized	Percent charged off or transferred to foreclosure	
Springfield	$1,384,274	$6,702,143	$8,086,417	75.2	.3	.2	4.0	20.3
Baltimore	599,855	5,960,143	6,559,998	82.0	3.4	.3	2.3	12.0
Columbia	1,767,242	7,973,573	9,740,815	63.9	9.9	.9	.9	24.4
Louisville	735,532	13,223,248	13,958,780	92.8	.6	[1]	.4	6.2
New Orleans	3,838,361	8,728,510	12,566,871	58.5	12.5	2.1	1.7	25.2
St. Louis	1,199,289	13,678,014	14,877,303	91.8	2.0	-------	1.1	5.1
St. Paul	9,591,807	24,306,937	33,898,744	44.3	22.4	.1	4.0	29.2
Omaha	8,343,627	26,804,215	35,147,842	58.2	14.1	.2	7.3	20.2
Wichita	3,647,217	14,925,368	18,572,585	63.1	4.4	.1	3.9	28.5
Houston	2,718,781	13,716,699	16,435,480	80.1	3.9	2.1	2.1	11.8
Berkeley	2,467,948	10,966,729	13,434,677	74.1	1.3	1.4	2.1	21.1
Spokane	4,053,202	10,778,646	14,831,848	56.1	14.0	.1	4.0	25.8
Total	40,347,135	157,764,225	198,111,360	65.8	9.8	.5	3.5	20.4

[1] Less than 0.1 percent.

TABLE 9.—*Principal payments, loans paid off prior to maturity, and loans closed during 1939*

Federal Land Bank of—	Principal payments	Loans paid off prior to maturity	Total payments on principal	Loans closed
Springfield	$2,906,332	$823,528	$3,729,860	$3,028,100
Baltimore	2,539,291	1,715,274	4,254,565	1,565,300
Columbia	2,975,034	1,523,641	4,498,675	2,194,000
Louisville	7,438,319	5,507,014	12,945,333	4,880,300
New Orleans	2,848,335	1,605,816	4,454,151	3,253,000
St. Louis	7,062,219	4,717,171	11,779,390	7,293,600
St. Paul	4,944,996	2,210,907	7,155,903	2,939,400
Omaha	7,371,619	4,613,557	11,985,176	9,178,000
Wichita	5,327,235	2,154,036	7,481,271	4,821,300
Houston	6,191,057	6,246,658	12,437,715	4,636,500
Berkeley	5,351,041	1,671,558	7,022,599	4,020,500
Spokane	3,329,696	1,376,079	4,705,775	3,771,500
Total	58,285,174	34,165,239	92,450,413	51,581,500

FEDERAL LAND BANKS

TABLE 10.—*Classification of mortgage loans outstanding Dec. 31, 1939, by States*

District and State	Number of loans outstanding	Classified as not delinquent				Classified as delinquent (loans with matured installments unpaid and loans with delinquent extensions)	
		With all matured installments paid in full		With all matured unpaid installments extended with no delinquency in extensions			
		Number	Percent	Number	Percent	Number	Percent
District 1:							
Maine	3,148	1,778	56.5			1,370	43.5
New Hampshire	750	668	89.1			82	10.9
Vermont	2,130	1,727	81.1			403	18.9
Massachusetts	3,093	2,735	88.4			358	11.6
Rhode Island	470	404	86.0			66	14.0
Connecticut	2,592	2,291	88.4			301	11.6
New York	14,268	11,733	82.2			2,535	17.8
New Jersey	3,116	2,641	84.8			475	15.2
Total	29,567	23,977	81.1			5,590	18.9
District 2:							
Pennsylvania	9,199	8,218	89.3	88	1.0	893	9.7
Delaware	314	287	91.4			27	8.6
Maryland	2,349	2,052	87.3	6	.3	291	12.4
Virginia	11,168	9,847	88.2	60	.5	1,261	11.3
West Virginia	4,623	4,190	90.6	2	.1	431	9.3
Puerto Rico	3,747	2,785	74.3	335	9.0	627	16.7
Total	31,400	27,379	87.2	491	1.6	3,530	11.2
District 3:							
North Carolina	12,068	8,978	74.4	639	5.3	2,451	20.3
South Carolina	6,863	4,424	64.5	511	7.4	1,928	28.1
Georgia	12,753	8,199	64.3	1,080	8.5	3,474	27.2
Florida	4,488	3,183	70.9	698	15.6	607	13.5
Total	36,172	24,784	68.5	2,928	8.1	8,460	23.4
District 4:							
Ohio	19,144	17,505	91.4	60	.3	1,579	8.3
Indiana	25,496	23,643	92.7	159	.6	1,694	6.7
Kentucky	12,735	11,014	86.5	92	.7	1,629	12.8
Tennessee	13,872	12,494	90.1	118	.8	1,260	9.1
Total	71,247	64,656	90.7	429	.6	6,162	8.7
District 5:							
Alabama	20,155	13,703	68.0	202	1.0	6,250	31.0
Mississippi	16,885	11,197	66.3	232	1.4	5,456	32.3
Louisiana	10,432	7,754	74.3	44	.4	2,634	25.3
Total	47,472	32,654	68.8	478	1.0	14,340	30.2
District 6:							
Illinois	24,822	22,970	92.5	205	.8	1,647	6.7
Missouri	14,215	12,440	87.5	447	3.2	1,328	9.3
Arkansas	10,463	9,585	91.6	219	2.1	659	6.3
Total	49,500	44,995	90.9	871	1.8	3,634	7.3

FEDERAL LAND BANKS

TABLE 10.—*Classification of mortgage loans outstanding Dec. 31, 1939, by States*—Continued

District and State	Number of loans outstanding	Classified as not delinquent				Classified as delinquent (loans with matured installments unpaid and loans with delinquent extensions)	
		With all matured installments paid in full		With all matured unpaid installments extended with no delinquency in extensions			
		Number	Percent	Number	Percent	Number	Percent
District 7:							
Michigan	22,337	19,309	86.4	80	.4	2,948	13.2
Wisconsin	23,500	17,035	72.5	274	1.2	6,191	26.3
Minnesota	29,017	23,020	79.3	124	.4	5,873	20.3
North Dakota	18,679	5,080	27.2	613	3.3	12,986	69.5
Total	93,533	64,444	68.9	1,091	1.2	27,998	29.9
District 8:							
Iowa	33,302	28,709	86.2	558	1.7	4,035	12.1
South Dakota	13,556	8,121	59.9	884	6.5	4,551	33.6
Nebraska	24,738	13,976	56.5	671	2.7	10,091	40.8
Wyoming	3,074	2,353	76.5	30	1.0	691	22.5
Total	74,670	53,159	71.2	2,143	2.9	19,368	25.9
District 9:							
Kansas	26,508	16,605	62.6	661	2.5	9,242	34.9
Oklahoma	14,481	11,864	81.9	118	.8	2,499	17.3
Colorado	9,432	6,776	71.9	144	1.5	2,512	26.6
New Mexico	4,592	3,997	87.1	56	1.2	539	11.7
Total	55,013	39,242	71.3	979	1.8	14,792	26.9
District 10: Texas	67,819	55,157	81.3	2,193	3.2	10,469	15.5
District 11:							
Arizona	2,082	1,625	78.0	2	.1	455	21.9
Utah	5,581	3,937	70.5	40	.7	1,604	28.8
Nevada	433	328	75.8	1	.2	104	24.0
California	18,361	14,435	78.6	4	(1)	3,922	21.4
Total	26,457	20,325	76.8	47	.2	6,085	23.0
District 12:							
Montana	5,912	3,868	65.4	292	5.0	1,752	29.6
Idaho	9,196	7,311	79.5	51	.6	1,834	19.9
Washington	12,132	10,249	84.5	136	1.1	1,747	14.4
Oregon	8,366	6,887	82.3	158	1.9	1,321	15.8
Total	35,606	28,315	79.5	637	1.8	6,654	18.7
Grand total	618,456	479,087	77.5	12,287	2.0	127,082	20.5

[1] Less than 0.1 percent.

FEDERAL LAND BANKS

TABLE 11.—*Real estate, sheriffs' certificates, etc., acquired and disposed of during 1939, by banks*

Federal Land Bank of—	Acquisitions		Disposals				
	Number	Investment	Number		Investment	Consideration	Consideration as a percent of investment
			Whole	Part			
Springfield	637	$2,160,220	663	43	$2,603,031	$2,178,582	83.7
Baltimore	307	945,954	511	41	1,663,474	1,093,887	65.8
Columbia	244	577,602	338	39	802,338	622,801	77.6
Louisville	125	515,430	253	35	1,400,137	1,154,286	82.4
New Orleans	442	1,056,613	1,005	200	2,696,948	2,190,945	81.2
St. Louis	421	1,535,333	861	70	3,628,481	2,597,627	71.6
St. Paul	3,506	13,963,988	1,765	184	7,349,664	4,462,447	60.7
Omaha	2,580	15,251,748	1,099	111	7,161,778	4,850,384	67.7
Wichita	1,718	6,403,401	838	91	3,093,686	2,280,096	73.7
Houston	589	2,203,144	643	68	2,105,545	1,554,083	73.8
Berkeley	242	1,195,926	401	66	1,907,553	1,262,300	66.2
Spokane	547	1,995,029	1,159	92	4,083,438	2,455,388	60.1
Total	11,358	47,804,388	9,536	1,040	38,496,073	26,702,826	69.4

TABLE 12.—*Real estate, sheriffs' certificates, etc., held, Dec. 31, 1939, by States*

District and State	Farms owned outright		Sheriffs' certificates, etc.	
	Number	Investment	Number	Investment
District 1:				
Maine	165	$591,174		
New Hampshire	16	69,383		
Vermont	30	117,110		
Massachusetts	62	337,692		
Rhode Island	3	12,846		
Connecticut	12	58,952		
New York	220	1,023,802		
New Jersey	41	256,747		
Total	549	2,467,706		
District 2:				
Pennsylvania	189	604,178		
Delaware	4	13,949		
Maryland	36	149,335		
Virginia	118	452,568		
West Virginia	78	251,739		
Puerto Rico	26	93,900		
Total	451	1,565,669		
District 3:				
North Carolina	20	73,588		
South Carolina	17	60,031		
Georgia	26	69,691		
Florida	21	53,018		
Total	84	256,328		

FEDERAL LAND BANKS

TABLE 12.—*Real estate, sheriffs' certificates, etc., held, Dec. 31, 1939, by States*—Continued

District and State	Farms owned outright		Sheriffs' certificates, etc.	
	Number	Investment	Number	Investment
District 4:				
Ohio	38	$267,577		
Indiana	108	759,955	32	$190,980
Kentucky	25	93,574	2	4,288
Tennessee	27	90,780		
Total	198	1,211,886	34	195,268
District 5:				
Alabama	167	289,482	67	148,993
Mississippi	439	1,227,291		
Louisiana	75	338,737		
Total	681	1,855,510	67	148,993
District 6:				
Illinois	115	1,135,448	57	349,577
Missouri	201	1,083,384	5	18,273
Arkansas	60	137,531	13	35,151
Total	376	2,356,363	75	403,001
District 7:				
Michigan	475	1,880,375	97	278,064
Wisconsin	1,674	8,403,716	1	4,187
Minnesota	1,662	9,081,074	393	1,724,102
North Dakota	4,686	22,311,020	1,433	6,418,713
Total	8,497	41,676,185	1,924	8,425,066
District 8:				
Iowa	324	3,132,384	249	2,407,345
South Dakota	2,979	17,670,505	635	3,019,055
Nebraska	1,363	9,768,192		
Wyoming	35	98,147	14	53,020
Total	4,701	30,669,228	898	5,479,420
District 9:				
Kansas	751	3,311,871	1,081	4,538,881
Oklahoma	198	690,940		
Colorado	1,149	3,414,127	140	433,668
New Mexico	108	219,116	30	57,429
Total	2,206	7,636,054	1,251	5,029,978
District 10: Texas	678	2,963,457		
District 11:				
Arizona	14	106,072		
Utah	191	885,287	36	158,491
Nevada	6	80,291	1	6,101
California	99	779,858	20	131,453
Total	310	1,851,508	57	296,045
District 12:				
Montana	1,620	5,694,936	41	201,742
Idaho	351	2,042,925	32	162,020
Washington	391	1,727,808	49	157,759
Oregon	242	1,231,577	37	187,894
Total	2,604	10,697,246	159	709,415
Grand total	21,335	105,207,140	4,465	20,687,186

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TABLE 13.—*Bonds issued and retired or called during 1939, and outstanding, Dec. 31, 1939, by type of bond*

Type of bond	Bonds issued during 1939	Bonds retired or called during 1939	Bonds outstanding, Dec. 31, 1939 [1]
Consolidated	$6,100,000	$53,072,400	$1,766,127,840
Individual		737,280	
Total	6,100,000	53,809,680	1,766,127,840

[1] Includes bonds on hand.

TABLE 14.—*Consolidated Federal farm loan bonds outstanding, Dec. 31, 1939, by date of issue* [1]

Date of issue	Term (years)	Rate (percent)	Maturity	Amount
July 1, 1933	10–30	4	July 1, 1963	$59,170,000
Mar. 15, 1934	10–30	4	Mar. 15, 1964	54,557,400
May 15, 1934	10–30	4	May 15, 1964	426,616,440
July 1, 1934	10–12	4	July 1, 1946	133,463,500
July 15, 1934	10–30	4	July 15, 1964	147,800,000
Sept. 15, 1934	10–30	4	Sept. 15, 1964	55,610,900
Mar. 15, 1935	10–30	3½	Mar. 15, 1965	5,704,600
Mar. 15, 1935	10–30	3¼	Mar. 15, 1965	39,045,900
Mar. 15, 1935	10–30	3	Mar. 15, 1965	73,824,600
May 1, 1935	10–20	3¼	May 1, 1955	159,807,700
July 1, 1935	10–20	3	July 1, 1955	236,003,000
Jan. 1, 1936	10–20	3	Jan. 1, 1956	180,778,200
May 1, 1936	10–20	3	May 1, 1956	193,745,600
Total				1,766,127,840

[1] Includes bonds on hand.

FEDERAL LAND BANKS

TABLE 15.—*Individual and consolidated Federal farm loan bonds outstanding, Dec. 31 of each year, 1917–39*

As of Dec. 31—	Individual [1]	Consolidated [1]	Total [1]
1917	(2)		(2)
1918	(2)		(2)
1919	(2)		(2)
1920	(2)		(2)
1921	$432,761,315		$432,761,315
1922	642,708,375		642,708,375
1923	806,669,330		806,669,330
1924	914,763,400		914,763,400
1925	982,192,440		982,192,440
1926	1,059,216,615		1,059,216,615
1927	1,139,616,660		1,139,616,660
1928	1,177,381,260		1,177,281,260
1929	1,190,245,780		1,190,245,780
1930	1,186,438,320		1,186,438,320
1931	1,170,828,980		1,170,828,980
1932	1.148,190,740		1,148,190,740
1933	1,143,840,160	$98,500,000	1,242,340,160
1934	968,581,120	816,861,240	1,785,442,360
1935	536,744,340	1,391,523,240	1,928,267,580
1936	205,674,100	1,758,980,340	1,964,654,440
1937	37,481,740	1,829,750,340	1,867,232,080
1938	737,280	1,813,100,240	1,813,837,520
1939		1,766,127,840	1,766,127,840

[1] Includes bonds on hand and excludes bonds matured or called.
[2] Not available.

TABLE 16.—*Collateral pledged with registrar by the Federal land banks for consolidated and individual Federal farm loan bonds outstanding, Dec. 31, 1939*

Item	Consolidated bonds	Individual bonds
Mortgage loans	$1,885,310,346	
U. S. Government obligations, direct and fully guaranteed (par)	20,335,000	
Cash deposited for matured or called bonds		$2,179,575
Total collateral	1,905,645,346	2,179,575
Bonds outstanding (including matured or called bonds)	1,766,127,840	2,179,575
Excess collateral	139,517,506	

FEDERAL LAND BANKS

TABLE 17.—*Capital stock outstanding, Dec. 31, 1939, by banks and by type of owner*

Federal Land Bank of—	Type of owner				Percent of total owned by national farm loan associations and borrowers with direct loans
	U. S. Government	National farm loan associations	Borrowers with direct loans	Total	
Springfield	$4,147,525	$4,194,975	$168,960	$8,511,460	51.3
Baltimore	5,759,200	3,579,460	881,630	10,220,290	43.6
Columbia	14,622,010	3,470,055	601,525	18,693,590	21.8
Louisville	4,087,815	11,038,945	27,735	15,154,495	73.0
New Orleans	14,622,775	4,138,885	738,680	19,500,340	25.0
St. Louis	7,718,765	11,209,090	35,115	18,962,970	59.3
St. Paul	39,570,030	15,737,875	194,035	55,501,940	28.7
Omaha	5,855,175	21,606,405	17,800	27,479,380	78.7
Wichita	5,596,290	8,644,200	612,020	14,852,510	62.3
Houston	5,187,785	11,619,785	2,045	16,809,615	69.1
Berkeley	3,552,835	6,738,860	56,660	10,348,355	65.7
Spokane	14,279,795	5,808,335	352,890	20,441,020	30.1
Total	125,000,000	107,786,870	3,689,095	236,475,965	47.1

TABLE 18.—*Capital stock outstanding on Dec. 31 of each year from 1917 through 1939, by type of owner*

As of Dec. 31—	Type of owner				Percent of total owned by national farm loan associations and borrowers with direct loans
	U. S. Government	National farm loan associations	Borrowers with direct loans	Total	
1917	$8,892,130	$1,932,683	$113,490	$10,938,303	18.7
1918	8,765,415	7,838,508	123,516	16,727,439	47.6
1919	7,693,240	14,780,833	100,995	22,575,068	65.9
1920	6,832,680	17,663,725	95,110	24,591,515	72.2
1921	6,598,770	21,997,145	111,255	28,707,170	77.0
1922	4,264,880	32,602,215	135,820	37,002,915	88.5
1923	2,434,385	40,926,390	252,080	43,612,855	94.4
1924	1,670,965	47,524,335	401,775	49,597,075	96.6
1925	1,331,930	51,929,868	521,675	53,783,473	97.5
1926	1,058,885	56,073,365	632,045	57,764,295	98.2
1927	710,651	60,704,385	711,825	62,126,861	98.9
1928	439,225	63,545,055	773,035	64,757,315	99.3
1929	325,983	64,594,535	814,935	65,735,453	99.5
1930	267,724	65,028,560	837,115	66,133,399	99.6
1931	204,698	64,645,328	826,105	65,676,131	99.7
1932	125,046,410	63,197,033	804,400	189,047,843	33.9
1933	124,648,398	68,290,874	1,328,345	194,267,617	35.8
1934	117,617,300	100,371,658	3,605,335	221,594,293	46.9
1935	123,097,895	109,319,814	3,573,555	235,991,264	47.8
1936	124,066,135	110,994,430	3,492,785	238,553,350	48.0
1937	124,121,595	110,410,985	3,432,930	237,965,510	47.8
1938	124,960,250	109,693,516	3,635,945	238,289,711	47.6
1939	125,000,000	107,786,870	3,689,095	236,475,965	47.1

FEDERAL LAND BANKS

TABLE 19.—*Interest reduction granted borrowers for which reimbursement is obtained from the Secretary of the Treasury*

Federal Land Bank of—	Interest reduction granted borrowers	
	1939	Total 1933–39
Springfield	$1,084,106	$6,133,251
Baltimore	1,246,354	7,403,556
Columbia	1,140,942	7,023,885
Louisville	2,958,377	16,702,482
New Orleans	1,223,339	9,059,441
St. Louis	2,643,314	14,468,742
St. Paul	4,343,366	23,754,905
Omaha	5,382,624	28,737,144
Wichita	2,353,894	13,405,884
Houston	3,281,796	19,133,628
Berkeley	1,776,862	9,748,063
Spokane	1,740,520	10,392,400
Total	29,175,494	165,963,381

TABLE 20.—*Subscription to paid-in surplus by the Secretary of the Treasury for deferments and extensions granted borrowers* [1]

Federal Land Bank of—	Subscription to paid-in surplus			Repaid during 1939	Balance, Dec. 31, 1939
	1933–38	1939	Total		
Springfield	$10,628,281	$300,268	$10,928,549	$200,000	$10,728,549
Baltimore	4,777,679	81,394	4,859,073	173,822	4,685,251
Columbia	9,236,230	417,723	9,653,953		9,653,953
Louisville	10,598,479	25,697	10,624,176	490,658	10,133,518
New Orleans	15,905,759	471,470	16,377,229	525,199	15,852,030
St. Louis	12,951,901	117,029	13,068,930	75,108	12,993,822
St. Paul	27,540,185	2,167,804	29,707,989		29,707,989
Omaha	26,743,181	2,008,162	28,751,343		28,751,343
Wichita	15,396,223	424,734	15,820,957	528,530	15,292,427
Houston	13,183,829	196,420	13,380,249	100,000	13,280,249
Berkeley	20,747,844		20,747,844	225,000	20,522,844
Spokane	15,600,036	673,349	16,273,385		16,273,385
Total	183,309,627	6,884,050	190,193,677	2,318,317	187,875,360

[1] The deferment privilege expired on July 10, 1938; all subscriptions to paid-in surplus subsequent to that date have been based on extensions granted.

FEDERAL LAND BANKS

TABLE 21.—*Consolidated statement of condition, Dec. 31, 1939*

ASSETS

Mortgage loans:			
Unpaid principal	$1,904,655,014.10		
Less matured principal unpaid (included in delinquent installments)	8,441,756.94	$1,896,213,257.16	
Purchase money mortgages, contracts, etc.:			
Purchase money first mortgages	40,541,384.12		
Purchase money second mortgages	2,032,054.39		
Real estate sales contracts and notes receivable	54,832,235.53		
Total (unpaid principal)	97,405,674.04		
Less matured principal unpaid (included in delinquent installments)	2,389,693.74	95,015,980.30	
Unmatured extensions		4,999,409.00	
Delinquent installments, advances, etc.:			
Mortgage loans	36,876,439.15		
Purchase money mortgages, contracts, etc.	3,600,424.64	40,476,863.79	
Accrued interest receivable on mortgage loans (not due)		27,374,427.24	
Total		2,064,079,937.49	
Less reserve		20,652,601.55	$2,043,427,335.94
Cash—General funds			37,183,869.38
Deposits with the Treasurer of the United States:			
Cash deposited for matured or called bonds		2,179,575.00	
Cash deposited for matured bond interest		760,567.54	
Cash deposited for unmatured consolidated bond interest		10,104,388.00	13,044,530.54
Due from the Secretary of the Treasury:			
Interest reduction		8,238,357.60	
Paid-in surplus		185,849.32	8,424,206.92
Accounts receivable:			
Due from Federal Farm Mortgage Corporation		1,310,472.75	
Other		231,944.45	1,542,417.20
U. S. Government obligations, direct and fully guaranteed (par $86,661,500)			88,874,173.31
Other bonds and securities			21,417.08
Accrued interest receivable on securities (not due):			
U. S. Government obligations, direct and fully guaranteed		300,556.08	
Other bonds and securities			300,556.08
Real estate owned (investment)		105,207,140.18	
Less reserve		37,871,917.18	67,335,223.00
Sheriffs' certificates, etc. (investment)		20,687,186.38	
Less reserve		7,160,345.94	13,526,840.44
Loans called for foreclosure, judgments, etc. (investment)		19,759,880.47	
Less reserve		6,318,329.13	13,441,551.34
Furniture, fixtures, equipment, etc.		3,118,832.28	
Less reserve		2,046,437.67	1,072,394.61
Bank buildings		5,596,268.33	
Less reserve		801,310.25	4,794,958.08
Deferred expense:			
Unamortized discount on Federal farm loan bonds sold		4,842,537.79	
Other		1,606,962.93	6,449,500.72
Other assets			733,357.77
Total assets			2,300,172,332.41

FEDERAL LAND BANKS

TABLE 21.—*Consolidated statement of condition, Dec. 31, 1939—Continued*

LIABILITIES

Consolidated Federal farm loan bonds:		
Outstanding	$1,766,127,840.00	
Less on hand	[1] 23,292,900.00	$1,742,834,940.00
Matured obligations:		
Federal farm loan bonds matured or called	2,179,575.00	
Matured interest on Federal farm loan bonds	760,567.54	2,940,142.54
Notes payable		4,556,400.00
Accrued interest payable (not due):		
Federal farm loan bonds	19,064,427.25	
Notes payable	8,127.50	19,072,554.75
Deferred proceeds of loans		596,121.16
Accounts payable		460,976.63
Dividends declared but unpaid		59,708.47
Trust accounts		6,516,576.19
Payments received on unmatured items:		
Installments—Mortgage loans	2,353,563.49	
Installments—Purchase money mortgages, contracts, etc	194,167.73	
Unmatured extensions	69,443.07	2,617,174.29
Taxes and assessments due on bank-owned real estate		1,669,541.27
Other liabilities		2,401,609.94
Deferred income:		
Unamortized premium on Federal farm loan bonds sold	192,751.71	
Other	1,105.50	193,857.21
Reserve for title losses		363,328.00
Capital stock owned by:		
U. S. Government	125,000,000.00	
National farm loan associations	107,786,870.00	
Direct borrowers and others	3,689,095.00	236,475,965.00
Paid-in surplus		187,875,359.89
Legal reserve		56,921,681.62
Reserve for contingencies		19,994,203.85
Earned surplus		5,000,000.00
Undivided profits		9,622,191.60
Total liabilities		2,300,172,332.41

[1] Of this amount, $1,800,000 is pledged as collateral to notes payable.

FEDERAL LAND BANKS

TABLE 22.—*Consolidated profit and loss statements for the years ended Dec. 31, 1939, and Dec. 31, 1938*

	Jan. 1 to Dec. 31, 1939		Jan. 1 to Dec. 31, 1938	
EARNINGS				
Interest:				
Mortgage loans	$97,681,291.00		$101,642,604.84	
U. S. Government obligations, direct and fully guaranteed, and other securities	1,986,186.56		1,590,937.20	
Extensions and defaulted payments	1,784,623.19		2,601,765.07	
Purchase money mortgages and contracts	4,472,466.02	$105,924,566.77	5,195,816.97	$111,031,124.08
Other income:				
Loan fees	264,806.17		360,340.35	
Miscellaneous	161,876.96	426,683.13	182,702.07	543,042.42
Gross earnings		106,351,249.90		111,574,166.50
DEDUCTIONS FROM EARNINGS				
Interest:				
Federal farm loan bonds	61,892,429.12		63,011,420.77	
Notes payable	296,441.29		1,112,400.23	
Other interest expense	47,022.08		41,371.31	
Total	62,235,892.49		64,165,192.31	
Operating expense	13,013,699.01		13,064,968.73	
Total deductions from gross earnings		75,249,591.50		77,230,161.04
Net operating earnings		31,101,658.40		34,344,005.46
OTHER EARNINGS				
Mortgage loan and real estate transactions:				
Recoveries from national farm loan associations	1,512,596.80		877,514.26	
Miscellaneous			223.12	
Total	1,512,596.80		877,737.38	
Premium and discount on securities (amortized), and profit on securities transactions	337,451.05		824,103.04	
Miscellaneous other additions	186,930.22	2,036,978.07	380,392.12	2,082,232.54
OTHER DEDUCTIONS				
Mortgage loan and real estate transactions:				
Net loss on real estate	11,453,172.91		9,496,788.47	
Miscellaneous	196,786.56		94,481.63	
Total	11,649,959.47		9,591,270.10	
Premium and discount on securities (amortized), and loss on securities transactions	1,118,145.00		1,033,203.22	
Miscellaneous other deductions		12,768,104.47	69,458.71	10,693,932.03
Net profit before adjustment of reserves		20,370,532.00		25,732,305.97
Adjustment of reserves (net)	7,723,985.52		12,868,843.01	
Adjustment—Deferred income on real estate sales			+3,115,059.59	
Total adjustment		7,723,985.52		9,753,783.42
Net profit after adjustment of reserves		12,646,546.48		15,978,522.55

NATIONAL FARM LOAN ASSOCIATIONS

TABLE 23.—*Charters issued and canceled during 1939, and number of associations as of Dec. 31, 1939, by districts*

District	Associations in operation, Jan. 1, 1939	Charters issued during 1939	Charters canceled during 1939	Associations in operation, Dec. 31, 1939		
				Total	Records at bank	Active
Springfield	165	1	2	164	29	135
Baltimore	210			210		210
Columbia	383	7	17	373	58	315
Louisville	471	10	20	461		461
New Orleans	271	11	24	258	5	253
St. Louis	380	19	52	347		347
St. Paul	637	56	170	523	7	516
Omaha	502	6	18	490		490
Wichita	329	6	14	321		321
Houston	325	5	12	318	1	317
Berkeley	173	2	4	171	41	130
Spokane	359	38	123	274	47	227
Total	4,205	161	456	3,910	188	3,722

NATIONAL FARM LOAN ASSOCIATIONS

TABLE 24.—*Attendance at national farm loan associations' annual meetings held during 1939*

District and State	Members present	Visitors			Total attendance
		L. B. C. borrowers	Direct borrowers	Nonborrowers	
District 1:					
Maine	250	17	1	66	334
New Hampshire	50	1	3	11	65
Vermont	151			32	183
Massachusetts	259	2	4	198	463
Rhode Island	18			10	28
Connecticut	146	6		66	218
New York	775	7	4	193	979
New Jersey	224	17	1	60	302
Total	1,873	50	13	636	2,572
District 2:					
Pennsylvania	2,279	274	189	1,797	4,539
Delaware	136	24		129	289
Maryland	629	63	13	553	1,258
Virginia	2,955	410	119	2,413	5,897
West Virginia	1,056	223	26	1,447	2,752
Puerto Rico					
Total	7,055	994	347	6,339	14,735
District 3:					
North Carolina	2,030	71	3	510	2,614
South Carolina	718	40	7	242	1,007
Georgia	2,051	328	97	670	3,146
Florida	502	23	1	160	686
Total	5,301	462	108	1,582	7,453
District 4:					
Ohio	4,491	434	60	1,741	6,726
Indiana	6,241	527	4	1,954	8,726
Kentucky	3,315	598	2	802	4,717
Tennessee	3,523	700		878	5,101
Total	17,570	2,259	66	5,375	25,270
District 5:					
Alabama	2,149	493	264	1,308	4,214
Mississippi	2,331	858	427	2,903	6,519
Louisiana	951	171	64	676	1,862
Total	5,431	1,522	755	4,887	12,595
District 6:					
Illinois	4,278	296	18	3,944	8,536
Missouri	2,918	733	77	2,821	6,549
Arkansas	1,316	346	44	864	2,570
Total	8,512	1,375	139	7,629	17,655

NATIONAL FARM LOAN ASSOCIATIONS

TABLE 24.—*Attendance at national farm loan associations' annual meetings held during 1939*—Continued

District and State	Members present	Visitors			Total attendance
		L. B. C. borrowers	Direct borrowers	Nonborrowers	
District 7:					
Michigan	2,893	360	8	2,712	5,973
Wisconsin	4,566	609	36	3,122	8,333
Minnesota	3,560	451	20	2,354	6,385
North Dakota	2,871	362	4	786	4,023
Total	13,890	1,782	68	8,974	24,714
District 8:					
Iowa	5,697	236	1	2,595	8,529
South Dakota	2,232	488		2,367	5,087
Nebraska	3,724	145	1	1,810	5,680
Wyoming	328	22		81	431
Total	11,981	891	2	6,853	19,727
District 9:					
Kansas	5,916	404	227	3,386	9,933
Oklahoma	1,870	259	49	1,418	3,596
Colorado	1,822	330	65	2,037	4,254
New Mexico	789	108	8	437	1,342
Total	10,397	1,101	349	7,278	19,125
District 10: Texas	11,770	1,211	138	9,216	22,335
District 11:					
Arizona	131	14		21	166
Utah	886	81		187	1,154
Nevada	68	16	4	24	112
California	2,978	631	74	981	4,664
Total	4,063	742	78	1,213	6,096
District 12:					
Montana	772	363	59	751	1,945
Idaho	1,467	129	59	881	2,536
Washington	2,281	160	34	1,422	3,897
Oregon	1,431	188	16	879	2,514
Total	5,951	840	168	3,933	10,892
Grand total	103,794	13,229	2,231	63,915	183,169

PRODUCTION CREDIT CORPORATIONS

TABLE 25.—*Consolidated statement of condition, Dec. 31, 1939*

ASSETS

Class A stock of production credit associations	$75,369,874.68	
Less reserve for class A stock investments	339,000.00	$75,030,874.68
Cash:		
On hand and in banks	351,708.91	
On deposit with Treasurer of the United States	4,036.85	
Association funds held in trust		355,745.76
U. S. Government obligations, direct and fully guaranteed (par)	34,267,550.00	
Less sold under repurchase agreement [1]	14,279,850.00	19,987,700.00
Consolidated Federal farm loan bonds (par)	101,200,000.00	
Less sold under repurchase agreement [1]	75,023,750.00	26,176,250.00
Accounts receivable		11,208.61
Accrued interest receivable (net):		
U. S. Government obligations, direct and fully guaranteed	71,467.76	
Consolidated Federal farm loan bonds	385,978.33	457,446.09
Automobiles, furniture, fixtures, and equipment (net)		
Bank building [2]		33,450.06
Prepaid and deferred expense		2,707.85
Other assets		35,756.64
Total assets		122,091,139.69

LIABILITIES

Accounts payable	$1,957.81
Due to production credit associations	
Capital stock	120,000,000.00
Earned surplus	2,089,181.88
Total liabilities	122,091,139.69

[1] These securities have been sold at par to production credit associations, but by agreement are subject to repurchase at par by the production credit corporations.

[2] This represents the investment in office quarters by the Production Credit Corporation of Berkeley.

PRODUCTION CREDIT ASSOCIATIONS

TABLE 26.—*Number of associations, paid-in capital stock, and number of class B stockholders, Dec. 31, 1939, by States*

District and State	Number of associations	Paid-in capital			Number of class B stockholders
		Total	Class A stock [1]	Class B stock	
District 1:					
Maine	8	$1,794,264	$1,464,084	$330,180	3,009
New Hampshire	1	182,965	165,490	17,475	314
Vermont	3	512,665	415,560	97,105	1,652
Massachusetts	4	659,789	577,539	82,250	938
Rhode Island	1	243,740	200,540	43,200	276
Connecticut	1	367,160	251,510	115,650	989
New York	13	2,387,185	1,890,340	496,845	6,631
New Jersey	4	726,265	586,905	139,360	1,595
Total	35	6,874,033	5,551,968	1,322,065	15,404
District 2:					
Pennsylvania	11	1,882,049	1,631,644	250,405	5,278
Delaware	1	152,340	135,640	16,700	412
Maryland	6	1,189,985	1,051,710	138,275	1,617
Virginia	13	1,812,627	1,603,485	209,142	4,654
West Virginia	4	562,275	502,075	60,200	1,023
Puerto Rico	1	705,440	602,150	103,290	327
Total	36	6,304,716	5,526,704	778,012	13,311
District 3:					
North Carolina	28	3,498,470	3,029,960	468,510	21,217
South Carolina	23	2,521,725	2,221,165	300,560	13,295
Georgia	33	3,256,215	2,862,400	393,815	15,185
Florida	10	1,514,240	1,239,455	274,785	3,250
Total	94	10,790,650	9,352,980	1,437,670	52,947
District 4:					
Ohio	12	2,539,225	2,018,515	520,710	11,891
Indiana	10	2,364,905	1,819,440	545,465	10,558
Kentucky	12	1,508,550	1,237,895	270,655	7,759
Tennessee	9	1,629,205	1,358,435	270,770	7,357
Total	43	8,041,885	6,434,285	1,607,600	37,565
District 5:					
Alabama	8	1,796,565	1,593,500	203,065	5,310
Mississippi	10	2,811,355	2,341,475	469,880	13,368
Louisiana	8	2,058,855	1,707,425	351,430	6,978
Total	26	6,666,775	5,642,400	1,024,375	25,656
District 6:					
Illinois	21	3,223,155	2,466,785	756,370	11,731
Missouri	15	2,078,555	1,634,805	443,750	8,769
Arkansas	17	2,556,525	2,212,645	343,880	9,455
Total	53	7,858,235	6,314,235	1,544,000	29,955

See footnote at end of table.

PRODUCTION CREDIT ASSOCIATIONS

TABLE 26.—*Number of associations, paid-in capital stock, and number of class B stockholders, Dec. 31, 1939, by States*—Continued

District and State	Number of associations	Paid-in capital			Number of class B stockholders
		Total	Class A stock [1]	Class B stock	
District 7:					
Michigan	15	$1,767,390	$1,524,600	$242,790	7,628
Wisconsin	21	2,472,140	1,995,505	476,635	12,758
Minnesota	26	2,792,550	2,343,000	449,550	9,417
North Dakota	10	1,126,505	1,000,730	125,775	3,561
Total	72	8,158,585	6,863,835	1,294,750	33,364
District 8:					
Iowa	17	2,638,730	2,282,840	355,890	3,245
South Dakota	10	1,590,595	1,361,520	229,075	3,226
Nebraska	14	2,174,790	1,848,220	326,570	2,743
Wyoming	1	565,505	405,240	160,265	281
Total	42	6,969,620	5,897,820	1,071,800	9,495
District 9:					
Kansas	14	2,021,580	1,761,605	259,975	3,427
Oklahoma	14	2,224,145	1,912,980	311,165	6,165
Colorado	8	1,744,870	1,345,800	399,070	1,915
New Mexico	5	1,089,430	813,625	275,805	765
Total	41	7,080,025	5,834,010	1,246,015	12,272
District 10: Texas	36	6,830,275	5,682,110	1,148,165	10,620
District 11:					
Arizona	2	746,510	576,295	170,215	808
Utah	2	788,660	603,935	184,725	717
Nevada	1	355,485	250,805	104,680	108
California	25	6,145,950	4,927,405	1,218,545	6,681
Total	30	8,036,605	6,358,440	1,678,165	8,314
District 12:					
Montana	11	2,530,140	1,939,630	590,510	3,057
Idaho	5	1,708,590	1,238,460	470,130	2,496
Washington	9	3,218,507	2,788,357	430,150	2,653
Oregon	8	2,196,976	1,674,361	522,615	1,608
Total	33	9,654,213	7,640,808	2,013,405	9,814
Grand total	541	93,265,617	77,099,595	16,166,022	258,717

[1] Includes $568,623 class A stock owned by private investors.

NOTE.—Includes data for associations which have been placed in liquidation.

PRODUCTION CREDIT ASSOCIATIONS

TABLE 27.—*Applications received and loans closed during 1939, loans outstanding Dec. 31, 1939, and median size of loans which matured during 1939, by States*

District and State	Number of applications received	Loans closed		Loans outstanding, Dec. 31, 1939		Median size loan [1]
		Number	Amount	Number	Amount	
District 1:						
Maine	1,009	703	$827,097	998	$773,944	$507
New Hampshire	432	301	321,386	227	176,504	460
Vermont	2,076	1,730	1,685,352	1,470	1,083,892	634
Massachusetts	1,047	772	1,017,346	610	614,083	551
Rhode Island	407	244	845,830	202	473,007	805
Connecticut	1,482	997	2,013,714	871	1,362,761	914
New York	8,930	6,792	9,349,862	5,464	5,371,703	696
New Jersey	2,126	1,499	2,353,611	1,202	1,400,166	680
Total	17,509	13,038	18,414,198	11,044	11,256,060	678
District 2:						
Pennsylvania	7,018	5,615	4,605,991	4,549	2,691,808	492
Delaware	493	405	281,137	332	189,692	360
Maryland [2]	1,947	1,603	2,867,098	1,316	1,543,263	473
Virginia	5,043	4,036	3,497,896	2,702	2,112,093	383
West Virginia	1,101	925	1,093,121	826	826,193	493
Puerto Rico	360	274	1,560,310	288	1,071,010	2,355
Total	15,962	12,858	13,905,553	10,013	8,434,059	466
District 3:						
North Carolina	20,326	18,871	7,934,915	3,897	1,090,726	255
South Carolina	12,178	11,030	4,633,283	1,617	596,566	227
Georgia	14,644	13,094	6,572,631	5,574	2,037,424	235
Florida	3,252	2,676	4,757,865	2,027	3,485,916	437
Total	50,400	45,671	23,898,694	13,115	7,210,632	243
District 4:						
Ohio	13,444	11,713	10,577,121	10,538	6,579,677	539
Indiana	12,134	9,881	11,870,226	9,303	7,032,628	623
Kentucky	8,666	7,252	5,162,126	6,808	3,643,991	325
Tennessee	8,959	6,836	5,053,798	5,760	3,291,669	336
Total	43,203	35,682	32,663,271	32,409	20,547,965	461
District 5:						
Alabama	5,705	4,865	4,214,915	2,468	1,657,727	232
Mississippi	14,258	12,460	8,368,498	4,673	1,650,608	204
Louisiana	7,542	6,711	6,004,307	2,044	1,661,780	279
Total	27,505	24,036	18,587,720	9,185	4,970,115	226
District 6:						
Illinois	13,594	11,951	17,573,960	9,579	9,552,827	736
Missouri	12,630	8,698	10,628,822	7,178	5,776,225	467
Arkansas	10,096	8,840	6,150,404	2,648	1,651,119	224
Total	36,320	29,489	34,353,186	19,405	16,980,171	464

See footnotes at end of table.

PRODUCTION CREDIT ASSOCIATIONS

TABLE 27.—*Applications received and loans closed during 1939, loans outstanding Dec. 31, 1939, and median size of loans which matured during 1939, by States*—Continued

District and State	Number of applications received	Loans closed		Loans outstanding, Dec. 31, 1939		Median size loan [1]
		Number	Amount	Number	Amount	
District 7:						
Michigan	6,593	5,723	$3,295,212	5,316	$2,287,500	387
Wisconsin	13,143	11,649	8,427,122	11,079	5,593,144	579
Minnesota	9,475	8,641	9,141,353	8,176	5,634,254	665
North Dakota	1,706	1,588	1,109,416	1,517	772,455	427
Total	30,917	27,601	21,973,103	26,088	14,287,353	518
District 8:						
Iowa	4,290	3,120	9,295,401	2,595	4,587,890	1,225
South Dakota	3,428	3,059	5,458,389	2,844	2,989,512	762
Nebraska	3,267	2,620	7,407,267	2,228	3,826,599	1,000
Wyoming	309	282	3,439,114	234	1,942,116	5,100
Total	11,294	9,081	25,600,171	7,901	13,346,117	958
District 9:						
Kansas	3,875	3,017	5,662,817	2,683	2,691,531	819
Oklahoma	6,596	5,347	6,399,746	3,834	3,123,778	328
Colorado	2,384	1,825	8,947,843	1,551	4,083,666	1,868
New Mexico	781	706	5,882,760	469	2,487,384	2,266
Total	13,636	10,895	26,893,166	8,537	12,386,359	602
District 10: Texas	11,797	10,549	30,497,697	7,103	12,026,835	595
District 11:						
Arizona	903	749	3,809,970	559	1,785,372	1,109
Utah	618	598	4,238,341	513	1,892,251	1,643
Nevada	110	101	2,577,759	92	1,190,054	[3]
California	7,135	5,450	22,366,340	4,172	8,641,376	1,005
Total	8,766	6,898	32,992,410	5,336	13,509,053	1,750
District 12:						
Montana [4]	3,378	2,918	14,642,608	2,262	7,152,540	1,672
Idaho	3,373	2,457	11,022,505	1,800	5,078,824	1,313
Washington	2,066	1,654	4,614,837	1,561	2,319,247	1,343
Oregon [4]	1,972	1,439	10,901,927	1,125	4,990,235	2,069
Total	10,789	8,468	41,181,877	6,748	19,540,846	1,559
Grand total	278,098	234,266	320,961,046	156,884	154,495,565	442

[1] One-half of the number of loans are smaller than this amount and one-half larger.

[2] Includes all of East Central Fruit Growers Production Credit Association of district 2.

[3] Over $5,000.

[4] Includes all of Northwest Livestock Production Credit Association of district 12.

NOTE.—Includes data for associations which have been placed in liquidation.

PRODUCTION CREDIT ASSOCIATIONS

TABLE 28.—*Applications received, loans closed, and loans outstanding, for specified periods*

Period	Number of applications received	Loans closed [1]		Loans outstanding at end of period	
		Number	Amount advanced	Number	Amount
Organization through Dec. 31, 1934	288,950	135,432	$107,243,065	[2] 70,379	$60,851,506
1935	297,566	218,814	196,306,112	116,929	94,095,723
1936	329,536	234,651	228,090,206	129,352	105,211,954
1937	334,269	245,799	286,577,842	144,729	138,168,896
1938	306,489	243,484	302,622,809	156,851	148,036,721
1939	278,098	234,266	320,961,046	156,884	154,495,565
1939:					
January	42,467	23,387	23,620,268	162,557	148,416,390
February	44,703	37,599	25,764,824	184,061	155,408,634
March	42,435	44,679	34,286,591	207,568	167,867,110
April	23,868	25,525	29,027,828	216,812	177,792,056
May	16,180	15,760	26,015,795	219,887	183,351,157
June	11,856	10,528	23,097,471	220,680	187,711,501
July	10,799	8,404	18,841,967	220,249	187,843,965
August	13,361	10,298	20,157,875	216,361	185,215,497
September	14,851	11,547	25,296,491	199,724	174,031,566
October	17,992	13,700	31,903,184	177,658	162,702,898
November	19,006	15,445	33,040,311	163,701	156,525,749
December	20,580	17,394	29,908,441	156,884	154,495,565

[1] Includes loans purchased from regional agricultural credit corporations.

[2] Does not include number of regional agricultural credit corporation loans purchased and outstanding.

NOTE.—Includes data for associations which have been placed in liquidation.

TABLE 29.—*Cash advanced on loans, losses, and provisions for losses*

District	Total cash advanced to Dec. 31, 1939	Total valuation reserves, Dec. 31, 1939	Charge-offs (net) organization to Dec. 31, 1939	Total losses and provision for losses		Loans outstanding, Dec. 31, 1939	Total legal reserves and undivided profits	
				Amount	Percent of cash advanced		Amount	Percent of loans outstanding
Springfield	$61,686,482	$327,586	$579,725	$907,311	1.5	$11,256,060	$591,212	5.3
Baltimore	45,839,138	93,963	136,297	230,260	.5	8,434,059	764,484	9.1
Columbia	102,419,567	176,290	133,401	309,691	.3	7,210,632	1,269,331	17.6
Louisville	90,775,464	142,556	92,580	235,136	.3	20,547,965	1,106,422	5.4
New Orleans	80,856,448	76,562	52,366	128,928	.2	4,970,115	1,281,203	25.8
St. Louis	95,410,636	71,996	69,841	141,837	.1	16,980,171	1,113,226	6.6
St. Paul	66,816,614	69,185	28,252	97,437	.1	14,287,353	1,188,188	8.3
Omaha	81,033,596	27,660	18,683	46,343	.1	13,346,117	1,279,268	9.6
Wichita	92,668,013	53,498	70,643	124,141	.1	12,386,359	1,554,054	12.5
Houston	85,519,782	101,564	45,622	147,186	.2	12,026,835	1,198,731	10.0
Berkeley	142,665,707	558,975	255,511	814,486	.6	13,509,053	1,393,480	10.3
Spokane	175,404,090	697,272	461,086	1,158,358	.7	19,540,846	1,703,903	8.7
Total	1,121,095,537	2,397,107	1,944,007	4,341,114	.4	154,495,565	14,443,502	9.3

NOTE.—Includes data for associations which have been placed in liquidation.

PRODUCTION CREDIT ASSOCIATIONS

TABLE 30.—*Number of farmers or stockmen owning class B stock in production credit associations in January of each year and attendance at stockholders' meetings, 1937, 1938, and 1939*

District and State	Number of farmers or stockmen owning class B stock in January of each year			Number of persons attending annual stockholders' meetings		
	1937	1938	1939	1937	1938	1939
District 1:						
Maine	676	849	849	283	468	473
New Hampshire	362	405	357	133	152	121
Vermont	1,274	1,494	1,677	493	623	747
Massachusetts	1,037	1,067	1,005	622	737	495
Rhode Island	254	281	295	211	188	149
Connecticut	837	961	1,019	376	411	502
New York	4,972	5,904	6,265	3,788	4,095	4,049
New Jersey	1,349	1,544	1,623	1,204	1,290	1,279
Total	10,761	12,505	13,090	7,110	7,964	7,815
District 2:						
Pennsylvania	3,935	4,748	5,099	2,599	2,112	2,024
Delaware	285	364	387	349	325	227
Maryland	1,539	1,630	1,661	877	1,163	910
Virginia	3,695	4,129	4,130	2,645	2,485	2,547
West Virginia	837	951	987	375	359	356
Total	10,291	11,822	12,264	6,845	6,444	6,064
District 3:						
North Carolina	20,114	20,871	21,756	10,383	12,453	11,470
South Carolina	15,476	15,242	14,396	6,309	6,383	6,673
Georgia	14,331	15,608	15,896	6,939	8,972	8,935
Florida	2,448	3,019	3,314	1,382	1,368	1,742
Total	52,369	54,740	55,362	25,013	29,176	28,820
District 4:						
Ohio	8,431	9,984	11,492	5,422	6,563	6,832
Indiana	8,017	9,239	10,050	2,945	5,012	6,005
Kentucky	4,475	5,527	6,566	1,636	3,434	3,743
Tennessee	7,111	7,155	7,147	2,296	1,998	2,951
Total	28,034	31,905	35,255	12,299	17,007	19,531
District 5:						
Alabama	6,528	6,366	5,699	2,647	3,137	2,537
Mississippi	12,166	13,871	14,747	4,191	5,398	5,186
Louisiana	6,278	7,170	7,743	3,694	4,805	4,749
Total	24,972	27,407	28,189	10,532	13,340	12,472
District 6:						
Illinois	7,579	9,245	10,438	5,712	6,833	8,243
Missouri	6,101	7,165	7,661	2,476	2,616	4,103
Arkansas	10,867	9,932	9,727	7,401	6,050	5,560
Total	24,547	26,342	27,826	15,589	15,499	17,906

PRODUCTION CREDIT ASSOCIATIONS

TABLE 30.—*Number of farmers or stockmen owning class B stock in production credit associations in January of each year and attendance at stockholders' meetings, 1937, 1938, and 1939*—Continued

District and State	Number of farmers or stockmen owning class B stock in January of each year			Number of persons attending annual stockholders' meetings[1]		
	1937	1938	1939	1937	1938	1939
District 7:						
Michigan	7,306	7,657	8,025	2,203	2,606	2,864
Wisconsin	10,548	11,703	12,887	6,300	9,355	9,534
Minnesota	9,714	9,846	10,271	4,842	5,656	6,634
North Dakota	4,193	2,169	2,002	1,277	1,943	2,177
Total	31,761	31,375	33,185	14,622	19,560	21,209
District 8:						
Iowa	2,413	2,935	3,203	1,879	3,259	3,482
South Dakota	3,189	3,144	3,236	889	1,741	2,170
Nebraska	2,844	2,583	2,653	1,781	2,980	3,238
Wyoming	313	285	287	67	94	65
Total	8,759	8,947	9,379	4,616	8,074	8,955
District 9:						
Kansas	4,122	3,788	3,708	2,055	3,150	3,437
Oklahoma	8,857	7,801	6,984	2,578	2,259	3,593
Colorado	1,866	1,747	1,780	980	1,539	1,654
New Mexico	772	721	714	621	844	816
Total	15,617	14,057	13,186	6,234	8,792	9,500
District 10: Texas	11,811	10,243	9,997	6,056	5,833	6,299
District 11:						
Arizona	188	626	834	86	246	168
Utah	605	786	789	173	263	202
Nevada	110	113	111	66	83	82
California	5,950	6,711	6,564	2,531	3,797	3,111
Total	6,853	8,236	8,298	2,856	4,389	3,563
District 12:						
Montana	3,723	3,542	3,391	1,207	2,170	2,378
Idaho	3,014	2,641	2,641	492	1,163	1,291
Washington	2,534	2,440	2,244	1,376	1,997	1,783
Oregon	1,370	1,611	1,709	649	1,201	1,306
Total	10,641	10,234	9,985	3,724	6,531	6,758
Grand total	236,416	247,813	256,016	115,496	142,609	148,892

[1] Includes stockholders and visitors.

PRODUCTION CREDIT ASSOCIATIONS

TABLE 31.—*Combined statement of condition of 528 associations in operation Dec. 31, 1939*

ASSETS

Loans		$153,674,803.60	
Less reserve		1,571,581.50	$152,103,222.10
Cash			5,002,678.01
Securities (par value):			
U. S. Government obligations, direct and fully guaranteed:			
Pledged	$9,937,550.00		
Unpledged	2,344,800.00	12,282,350.00	
Consolidated Federal farm loan bonds:			
Pledged	58,459,950.00		
Unpledged	13,669,800.00	72,129,750.00	84,412,100.00
Guaranty fund investment			3,002,200.00
Accrued interest receivable:			
Loans		3,387,970.41	
Less reserve		187,330.17	
Net		3,200,640.24	
Securities		1,310,136.04	4,510,776.28
Accounts receivable:			
Production credit corporations		15,032.43	
Federal intermediate credit banks		6,604.00	
Other		20,317.85	41,954.28
Assets acquired in liquidation of loans		491,849.98	
Less reserve		95,875.63	395,974.35
Furniture and fixtures (net)			290,088.55
Other assets			42,935.94
Total assets			249,801,929.51

LIABILITIES

Loans rediscounted with Federal intermediate credit banks			$130,402,216.53
Notes payable—Federal intermediate credit banks			13,819,586.20
Undisbursed proceeds of loans			438,374.45
Accounts payable:			
Production credit corporations		$105.46	
Federal intermediate credit banks		3,400.89	
Other		64,892.98	68,399.33
Accrued interest payable—Federal intermediate credit banks:			
Loans rediscounted		625,627.13	
Notes payable		57,487.62	683,114.75
Other liabilities			13,297.46
Capital stock:			
Class A:			
Production credit corporations	$73,612,860.00		
Other	563,916.47	74,176,776.47	
Class B (unimpaired)	15,432,765.00		
Class B (impaired)	106,015.00		
Less impairment	34,527.02	15,504,252.98	89,681,029.45
Reserve for guaranty fund			3,002,200.00
Other surplus reserves and undivided profits			11,693,711.34
Total liabilities			249,801,929.51

PRODUCTION CREDIT ASSOCIATIONS

TABLE 32.—*Combined statement of condition of 13 associations in active liquidation Dec. 31, 1939*

	Face amount	Less provision for estimated losses	Net amount
ASSETS			
Loans and related assets:			
Loans	$820,761.39	$438,735.72	$490,997.82
Uncollectible loans	108,972.15		
Assets acquired in liquidation of loans	91,396.24	46,114.48	45,281.76
Accrued interest receivable on loans	98,834.98	57,469.81	41,365.17
Accounts receivable	7,281.00		7,281.00
Total	1,127,245.76	542,320.01	584,925.75
Cash, securities, etc.:			
Cash			38,776.74
Securities			1,887,300.00
Accrued interest receivable on securities			25,949.71
Total			1,952,026.45
Miscellaneous:			
Furniture, fixtures, and equipment (net)			5,296.49
Other assets			35.00
Total			5,331.49
Total assets			2,542,283.69
LIABILITIES			
Due to Federal intermediate credit banks:			
Loans rediscounted			$80,944.46
Notes payable			680,426.83
Accrued interest payable:			
On loans rediscounted			298.13
On notes payable			1,824.67
Accounts payable			603.69
Total			764,097.78
Accounts payable:			
Production credit corporations			.12
Other than production credit corporations or Federal intermediate credit banks			325.97
Other liabilities			594.94
Total			921.03

	Par value	Impairments	Liquidating dividends [1]	
Capital stock:				
Class A—Production credit corporations	[2] $2,918,111.68		$1,161,100.00	1,757,011.68
Class A—Other	4,707.43		585.33	4,122.10
Class B (unimpaired)	229,647.10		46,885.00	182,762.10
Class B (impaired)	397,595.00	$311,816.66		85,778.34
Total	3,550,061.21	311,816.66	1,208,570.33	2,029,674.22
Undivided profits				−252,409.34
Total liabilities				2,542,283.69

[1] In addition to these amounts, 1 association paid liquidating dividends of $5,200.26 from undivided profits.

[2] The difference between the sum of this figure and the corresponding figure in table 31, and the amount shown in table 25, is due to the payment of liquidating dividends which have been credited to the corporations' investment in class A stock.

FEDERAL INTERMEDIATE CREDIT BANKS

TABLE 33.—*Loans and discounts during 1939, by banks and by type of institution*

Federal Intermediate Credit Bank of—	Loans to and discounts for financing institutions			Discounts for banks for cooperatives	Direct loans to cooperative associations	Total
	Production-credit associations	Other	Total			
Springfield	$20,369,877	$942,896	$21,312,773	$1,133,950	$2,000,000	$24,446,723
Baltimore	15,613,572	1,293,091	16,906,663	4,016,114		20,922,777
Columbia	35,216,487	828,230	36,044,717	739,310		36,784,027
Louisville	35,257,175	3,197,134	38,454,309	1,846,400		40,300,709
New Orleans	20,058,614	5,983,699	26,042,313	4,147,000		30,189,313
St. Louis	35,945,913	6,044,567	41,990,480	1,559,486	1,550,650	45,100,616
St. Paul	23,599,785	5,942,631	29,542,416	1,201,510		30,743,926
Omaha	27,448,397	3,801,339	31,249,736	495,625		31,745,361
Wichita	27,125,469	4,523,830	31,649,299	2,963,580		34,612,879
Houston	33,792,499	38,491,164	72,283,663	1,660,430		73,944,093
Berkeley	36,148,972	10,052,258	46,201,230	7,400,166	604,903	54,206,299
Spokane	41,112,930	5,456,829	46,569,759	2,369,136		48,938,895
Total	351,689,690	86,557,668	438,247,358	29,532,707	4,155,553	471,935,618

TABLE 34.—*Loans and discounts during 1939, by quarters and by type of institution*

Quarter ended	Loans to and discounts for financing institutions			Discounts for banks for cooperatives	Direct loans to cooperative associations	Total
	Production-credit associations	Other	Total			
Mar. 31	$93,388,655	$16,667,285	$110,055,940	$4,222,873	$1,161,903	$115,440,716
June 30	84,378,894	22,800,498	107,179,392	3,248,970	240,000	110,668,362
Sept. 30	69,589,939	17,906,769	87,496,708	9,754,745	777,650	98,029,103
Dec. 31	104,332,202	29,183,116	133,515,318	12,306,119	1,976,000	147,797,437
Total	351,689,690	86,557,668	438,247,358	29,532,707	4,155,553	471,935,618

TABLE 35.—*Loans to cooperative associations and discounts for banks for cooperatives outstanding Dec. 31 1939, by commodities*

Type of cooperative and commodity	Direct loans to cooperative associations	Discounts for banks for cooperatives
Marketing associations:		
Cotton		$6,541,092
Wheat and other grains		4,738,741
Canned fruits and vegetables		3,244,540
Clover, grass, and other seeds		1,334,951
Rice	$896,079	
Coffee		299,263
Tobacco		51,317
Dried fruits		18,219
Miscellaneous	38,650	1,682,940
Total	934,729	17,911,063
Purchasing associations	900,000	
Grand total	1,834,729	17,911,063

FEDERAL INTERMEDIATE CREDIT BANKS

TABLE 36.—*Loans and discounts outstanding, Dec. 31, 1939, by banks and by type of institution*

Federal Intermediate Credit Bank of—	Financing institutions			Banks for cooperatives	Cooperative associations	Total
	Production credit associations	Other	Total			
Springfield	$10,813,343	$523,394	$11,336,737	$240,000	$900,000	$12,476,737
Baltimore	7,938,590	1,150,054	9,088,644	2,072,159		11,160,803
Columbia	6,571,094	349,559	6,920,653	400,000		7,320,653
Louisville	19,818,540	1,329,861	21,148,401	975,000		22,123,401
New Orleans	4,617,248	907,208	5,524,456	3,813,000		9,337,456
St. Louis	16,548,571	2,980,465	19,529,036	282,312	934,729	20,746,077
St. Paul	13,591,315	4,465,297	18,056,612	1,176,510		19,233,122
Omaha	12,790,360	1,658,382	14,448,742	340,625		14,789,367
Wichita	11,778,699	2,091,341	13,870,040	2,253,741		16,123,781
Houston	11,271,524	11,774,903	23,046,427	437,936		23,484,363
Berkeley	12,752,926	4,074,228	16,827,154	4,275,286		21,102,440
Spokane	18,833,048	2,049,722	20,882,770	1,644,494		22,527,264
Total	147,325,258	33,354,414	180,679,672	17,911,063	1,834,729	200,425,464

TABLE 37.—*Loans and discounts outstanding at the end of each month during 1939, by type of institution*

End of month	Financing institutions			Banks for cooperatives	Cooperative associations	Total
	Production credit associations	Other	Total			
January	$142,283,335	$33,076,985	$175,360,320	$21,531,290	$834,381	$197,725,991
February	149,143,601	34,114,691	183,258,292	17,852,420	1,152,252	202,262,964
March	161,274,681	35,318,276	196,592,957	14,086,962	1,528,091	212,208,010
April	171,287,817	36,483,132	207,770,949	11,355,031	1,255,712	220,381,692
May	176,551,313	38,123,847	214,675,160	10,036,732	596,182	225,308,074
June	181,064,982	39,793,783	220,858,765	9,293,997	359,106	230,511,868
July	180,370,673	40,656,877	221,027,550	8,673,676	263,030	229,964,256
August	177,864,243	41,661,133	219,525,376	10,103,847	126,749	229,755,972
September	167,914,633	37,644,542	205,559,175	11,759,848	777,650	218,096,673
October	155,849,298	33,995,971	189,845,269	13,881,792	1,493,386	205,220,447
November	149,601,611	33,417,079	183,018,690	15,765,956	1,696,199	200,480,845
December	147,325,258	33,354,414	180,679,672	17,911,063	1,834,729	200,425,464

FEDERAL INTERMEDIATE CREDIT BANKS

TABLE 38.—*Loans to and discounts for financing institutions outstanding, at the end of each quarter of 1939, by States*

District and State	Mar. 31	June 30	Sept. 30	Dec. 31
District 1:				
Maine	$998,983	$1,323,609	$1,444,620	$1,116,666
New Hampshire	203,628	241,211	235,515	210,441
Vermont	1,263,416	1,324,518	1,291,433	1,202,906
Massachusetts	730,396	839,309	756,598	569,904
Rhode Island	468,888	459,449	500,495	453,246
Connecticut	1,132,776	1,329,461	1,484,094	1,301,672
New York	5,369,265	6,112,036	5,850,790	5,160,332
New Jersey	1,675,581	1,833,725	1,522,313	1,321,570
Total	11,842,933	13,463,318	13,085,858	11,336,737
District 2:				
Pennsylvania	2,420,064	2,786,252	2,661,005	2,565,158
Delaware	143,157	165,032	174,392	176,169
Maryland	1,122,901	1,439,723	1,431,817	1,444,408
Virginia	2,156,595	2,528,111	2,598,362	2,095,635
West Virginia	702,338	761,044	807,373	766,903
Puerto Rico	1,635,568	699,058	1,932,395	2,040,371
Total	8,180,623	8,379,220	9,605,344	9,088,644
District 3:				
North Carolina	5,475,219	7,391,514	5,987,337	901,492
South Carolina	3,359,847	4,210,743	2,052,943	457,967
Georgia	4,383,474	5,584,842	3,664,364	1,826,607
Florida	3,011,830	2,225,680	2,719,774	3,735,187
Total	16,230,370	19,412,779	14,424,418	6,920,653
District 4:				
Ohio	6,533,229	6,994,538	7,264,744	7,210,324
Indiana	6,101,362	6,783,036	7,035,365	7,436,676
Kentucky	2,863,854	3,139,917	3,592,636	3,555,475
Tennessee	3,194,505	3,727,930	3,826,572	3,197,189
Total	18,692,950	20,645,421	21,719,317	21,399,664
District 5:				
Alabama	2,426,971	2,934,228	2,749,193	1,793,998
Mississippi	5,916,636	9,038,400	6,835,776	1,996,221
Louisiana	3,721,111	5,283,948	4,629,057	1,779,218
Total	12,064,718	17,256,576	14,214,026	5,569,437
District 6:				
Illinois	8,099,590	9,185,735	10,684,648	10,600,648
Missouri	4,862,679	5,577,236	5,911,878	6,150,855
Arkansas	3,211,219	6,189,054	5,595,186	1,741,636
Total	16,173,488	20,952,025	22,191,712	18,493,139

FEDERAL INTERMEDIATE CREDIT BANKS

TABLE 38.—*Loans to and discounts for financing institutions outstanding, at the end of each quarter of 1939, by States*—Continued

District and State	Mar. 31	June 30	Sept. 30	Dec. 31
District 7:				
Michigan	$2,631,300	$2,670,256	$2,511,216	$2,353,777
Wisconsin	7,251,645	7,524,271	7,200,100	6,921,990
Minnesota	6,626,212	6,741,987	6,939,354	7,032,632
North Dakota	2,186,228	2,145,368	2,068,059	1,989,969
Total	18,695,385	19,081,882	18,718,729	18,298,368
District 8:				
Iowa	3,705,799	3,415,013	4,043,653	4,852,143
South Dakota	2,742,085	2,857,960	2,797,270	2,998,984
Nebraska	3,717,391	3,985,266	3,681,716	4,027,705
Wyoming	2,724,924	2,883,992	2,344,437	2,460,824
Total	12,890,199	13,142,231	12,867,076	14,339,656
District 9:				
Kansas	2,618,564	2,686,331	2,535,879	2,715,820
Oklahoma	5,026,064	5,319,779	4,002,854	4,616,116
Colorado	4,600,552	5,471,180	5,194,368	4,360,359
New Mexico	3,331,944	3,833,505	3,728,375	2,741,398
Total	15,577,124	17,310,795	15,461,476	14,433,693
District 10: Texas	22,869,915	24,282,830	21,193,758	23,076,932
District 11:				
Arizona	2,089,849	2,125,940	2,511,767	1,756,182
Utah	4,936,554	5,082,239	4,629,567	4,374,858
Nevada	1,476,031	1,529,172	1,088,964	1,149,610
California	11,936,339	13,805,940	13,640,812	9,634,440
Total	20,432,773	22,543,291	21,871,110	16,915,090
District 12:				
Montana	7,433,687	8,348,394	7,335,390	7,276,382
Idaho	5,471,134	5,563,256	4,222,754	5,168,312
Washington	4,394,089	4,583,739	3,548,070	3,683,716
Oregon	5,663,569	5,893,008	5,100,137	4,679,249
Total	22,942,479	24,388,397	20,206,351	20,807,659
Grand total	196,592,957	220,858,765	205,559,175	180,679,672

NOTE.—The district totals do not agree in all cases with those shown in table 36, because the banks have reported outstanding loans and discounts for institutions whose operations extend into States outside their own district.

FEDERAL INTERMEDIATE CREDIT BANKS

TABLE 39.—*Debentures issued during 1935 to 1939, inclusive, by months, and outstanding at the end of each month during 1939*

Month	Issued during month [1]										Outstanding at end of month, 1939 (par amount)
	1935		1936		1937		1938		1939		
	Face rate (percent)	Par amount	Face rate (percent)	Par amount	Face rate (percent)	Par amount	Face rate (percent)	Par amount	Face rate (percent)	Par amount	
January	1½	$36,550,000	1½	$37,250,000	1½	$29,850,000	1½	$23,600,000	1	$23,250,000	$172,725,000
February	1½	22,850,000	1½	14,980,000	1½	26,250,000	1½	34,350,000	1	18,700,000	173,225,000
March	1½	34,150,000	1½	22,050,000	1½	25,600,000	1½	31,750,000	1	22,450,000	182,500,000
April	1½	33,150,000	1½	21,000,000	1½	33,200,000	1½	28,050,000	1	25,450,000	188,600,000
May	1½	25,250,000	1½	10,220,000	1½	17,625,000	1½	34,950,000	1	18,600,000	193,400,000
June	1½	8,850,000	1½	13,050,000	1½	30,700,000	1	29,850,000	1	23,000,000	195,400,000
July	1½	11,120,000	1½	23,150,000	1½	36,250,000	1	27,250,000	1	15,950,000	197,650,000
August	1½	15,450,000	1½	11,200,000	1½	33,250,000	1	17,250,000	¾	17,750,000	196,050,000
September	1½	18,700,000	1½	22,990,000	1½	27,300,000	1	19,225,000	¾	30,000,000	205,300,000
October	1½	23,350,000	1½	22,050,000	1½	34,300,000	1	29,950,000	¾	32,400,000	207,600,000
November	1½	16,900,000	1½	23,770,000	1½	34,050,000	1	20,300,000	¾	28,900,000	207,400,000
December	1½	21,800,000	1½	24,850,000	1½	26,400,000	1	21,400,000	¾	26,450,000	207,200,000
Total		268,120,000		246,560,000		354,775,000		317,925,000		282,900,000	

[1] Beginning in October 1935 and thereafter, only consolidated debentures have been issued; the last of the debentures issued by the individual banks were retired in September 1936.

FEDERAL INTERMEDIATE CREDIT BANKS

TABLE 40.—*Consolidated statement of condition, Dec. 31, 1939*

ASSETS

Loans and discounts:			
Production credit associations		$147,325,257.75	
Other financing institutions	$33,354,414.48		
Less reserve	526,994.26	32,827,420.22	
Banks for cooperatives		17,911,062.90	
Cooperative associations		1,834,729.32	$199,898,470.19
Notes receivable		487,883.56	
Less reserve		316,252.80	171,630.76
Cash—General funds			52,032,731.66
Cash—Held as collateral			674,315.31
U. S. Government obligations, direct and fully guaranteed (at cost or par, whichever is lower)			74,799,536.74
Accounts receivable			7,251.97
Accrued interest receivable:			
Loans and discounts:			
Production credit associations		787,001.23	
Other financing institutions	88,345.68		
Less reserve		88,345.68	
Banks for cooperatives and cooperative associations		43,375.07	
Net		918,721.98	
Notes receivable	893.45		
Less reserve	810.12	83.33	
U. S. Government obligations, direct and fully guaranteed		196,954.07	1,115,759.38
Automobiles, furniture, fixtures, and equipment		335,782.65	
Less reserve		335,782.65	
Bank building [1]		52,001.42	
Less reserve		52,001.42	
Prepaid and deferred expense			376.20
Other assets		220,404.91	
Less reserve		157,048.25	63,356.66
Total assets			328,763,428.87

LIABILITIES

Unmatured consolidated debentures outstanding		$207,200,000.00
Notes payable		
Trust accounts		18,794.20
Accounts payable		7,257.48
Franchise tax payable		685,049.88
Liability for cash collateral		674,315.31
Deferred proceeds, loans and discounts		1,065.77
Accrued interest payable (not due):		
Debentures	$702,772.78	
Other		702,772.78
Interest collected, not earned		99,178.25
Unamortized premium on outstanding debentures		175,512.98
Other liabilities		39,097.39
Capital stock paid in	70,000,000.00	
Surplus paid in	30,000,000 00	
Reserve for contingencies	2,700,000.00	
Surplus earned	16,460,384.83	119,160,384.83
Total liabilities		328,763,428.87

[1] This represents the investment in banking quarters by the Federal Intermediate Credit Bank of Berkeley.

FEDERAL INTERMEDIATE CREDIT BANKS

TABLE 41.—*Statements of condition, Dec. 31, 1939*

ASSETS	Springfield		Baltimore		Columbia		Louisville	
Loans and discounts:								
Production credit associations	$10,813,343.09		$7,938,590.41		$6,571,093.79		$19,818,539.40	
Other financing institutions	523,394.03		1,150,053.97		349,559.47		1,329,861.02	
Banks for cooperatives	240,000.00		2,072,158.85		400,000.00		975,000.00	
Cooperative associations	900,000.00							
Total loans and discounts	12,476,737.12		11,160,803.23		7,320,653.26		22,123,400.42	
Less reserve (other financing institutions)		$12,476,737.12		$11,160,803.23		$7,320,653.26		$22,123,400.42
Notes receivable			51,736.05					
Less reserve			51,736.05					
Cash:								
General funds		2,843,892.22		1,987,295.15		2,705,371.56		6,879,750.68
Held as collateral		8,037.23				43,856.50		
U. S. Government obligations, direct and fully guaranteed (at cost or par, whichever is lower)		4,499,536.74		5,200,000.00		6,325,000.00		5,050,000.00
Accounts receivable				3,786.42		331.29		
Accrued interest receivable:								
Loans and discounts:								
Production credit associations	30,198.60		30,358.65		96,968.26		79,307.03	
Other financing institutions	1,310.07		7,302.53		729.73		6,446.91	
Banks for cooperatives and cooperative associations	1,245.42		7,269.71		1,391.92		4,920.86	
Notes receivable			79.66					
Total	32,754.09		45,010.55		99,089.91		90,674.80	
Less reserve			79.66					
Net accrued interest receivable on loans, discounts, and notes receivable	32,754.09		44,930.89		99,089.91		90,674.80	

U. S. Government obligations, direct and fully guaranteed	17,203.61	49,957.70	15,291.76	60,222.65	21,161.16	120,251.07	17,453.78	108,128.58
Automobiles, furniture, fixtures, and equipment	21,975.36		18,513.81		43,671.39		20,779.50	
Less reserve	21,975.36		18,513.81		43,671.39		20,779.50	
Bank building								
Less reserve								
Prepaid and deferred expense								
Other assets	3,000.00		50,263.05		8,391.71		6,000.00	
Less reserve		3,000.00	45,316.33	4,946.72	4,891.71	3,500.00		6,000.00
Total assets		19,881,161.01		18,417,054.17		16,518,963.68		34,167,279.68
LIABILITIES								
Unmatured consolidated debentures outstanding		$12,700,000.00		$11,350,000.00		$5,950,000.00		$26,375,000.00
Notes payable								
Trust accounts		1,715.14		4,796.19		25.00		
Accounts payable		930.36		1,762.93				
Franchise tax payable		40,965.47		30,745.40		27,117.51		65,712.36
Liability for cash collateral		8,037.23				43,856.50		
Deferred proceeds, loans and discounts								
Accrued interest payable (not due):								
Debentures	$49,816.67		$38,949.68		$12,181.29		$82,020.48	
Other		49,816.67		38,949.68		12,181.29		82,020.48
Interest collected, not earned		62.70		1,373.94				
Unamortized premium on outstanding debentures		10,838.04		9,004.06		1,211.57		24,812.31
Other liabilities		924.36		4,514.89		1,511.30		4,871.27
Capital stock paid in		5,000,000.00		5,000,000.00		5,000,000.00		5,000,000.00
Surplus paid in		400,000.00		800,000.00		5,200,000.00		800,000.00
Surplus earned		1,612,871.04		1,125,907.08		83,060.51		1,704,863.26
Reserve for contingencies		55,000.00		50,000.00		200,000.00		110,000.00
Total liabilities		19,881,161.01		18,417,054.17		16,518,963.68		34,167,279.68

FEDERAL INTERMEDIATE CREDIT BANKS

TABLE 41.—*Statements of condition, Dec. 31, 1939*—Continued

	New Orleans		St. Louis		St. Paul		Omaha	
ASSETS								
Loans and discounts:								
Production credit associations	$4,617,247.25		$16,548,571.21		$13,591,314.83		$12,790,360.33	
Other financing institutions	907,208.34		2,980,464.51		4,465,296.78		1,658,381.73	
Banks for cooperatives	3,813,000.00		282,311.54		1,176,510.30		340,625.00	
Cooperative associations			934,729.32					
Total loans and discounts	9,337,455.59		20,746,076.58		19,233,121.91		14,789,367.06	
Less reserve (other financing institutions)		$9,337,455.59		$20,746,076.58	200,000.00	$19,033,121.91		$14,789,367.06
Notes receivable			66,572.44		12,556.34		154,632.07	
Less reserve				66,572.44	12,556.34		50,000.00	104,632.07
Cash:								
General funds		2,910,887.29		5,322,480.55		5,035,425.55		2,587,077.12
Held as collateral		441.70		104,000.00		188,682.93		35,337.68
U. S. Government obligations, direct and fully guaranteed (at cost or par, whichever is lower)		3,650,000.00		4,275,000.00		9,350,000.00		7,150,000.00
Accounts receivable		121.33		1,327.31		556.38		131.85
Accrued interest receivable:								
Loans and discounts:								
Production credit associations	66,813.67		23,389.54		111,590.71		95,957.04	
Other financing institutions	5,289.91		2,017.55		13,351.80		14,650.74	
Banks for cooperatives and cooperative associations	11,720.03		2,476.80		3,225.67		1,080.56	
Notes receivable			83.33					
Total	83,823.61		27,967.22		128,168.18		111,688.34	
Less reserve								
Net accrued interest receivable on loans, discounts, and notes receivable	83,823.61		27,967.22		128,168.18		111,688.34	

U. S. Government obligations, direct and fully guaranteed	11,935.19	95,758.80	17,263.26	45,230.48	23,625.14	151,793.32	14,048.20	125,736.45
Automobiles, furniture, fixtures, and equipment	21,891.98		32,056.45		29,129.97		25,445.79	
Less reserve	21,891.98		32,056.45		29,129.97		25,445.79	
Bank building								
Less reserve								
Prepaid and deferred expense		25.00		50.00		50.00		
Other assets	4,922.45		5,500.00		3,926.51		6,321.08	
Less reserve	2,922.45	2,000.00		5,500.00	1,126.51	2,800.00	321.08	6,000.00
Total assets		15,996,689.71		30,566,237.36		33,762,430.09		24,798,282.32
LIABILITIES								
Unmatured consolidated debentures outstanding		$8,950,000.00		$23,300,000.00		$19,925,000.00		$13,200,000.00
Notes payable								
Trust accounts		820.92		7,435.31		1,893.02		451.86
Accounts payable				757.47		3,450.58		
Franchise tax payable		23,893.22		53,711.47		86,032.82		63,003.31
Liability for cash collateral		441.70		104,000.00		188,682.93		35,337.68
Deferred proceeds, loans and discounts								1,065.77
Accrued interest payable (not due):								
Debentures	$14,223.97		$79,541.36		$68,576.42		$35,062.87	
Other		14,223.97		79,541.36		68,576.42		35,062.87
Interest collected, not earned				11,757.45		21,170.89		
Unamortized premium on outstanding debentures		3,450.05		16,975.74		14,219.90		11,308.91
Other liabilities		5,990.01		1,314.84		8,280.06		1,984.51
Capital stock paid in		5,000,000.00		5,000,000.00		7,000,000.00		6,000,000.00
Surplus paid in		1,200,000.00		500,000.00		3,700,000.00		2,800,000.00
Surplus earned		747,869.84		1,425,743.72		1,865,123.47		2,350,067.41
Reserve for contingencies		50,000.00		65,000.00		880,000.00		300,000.00
Total liabilities		15,996,689.71		30,566,237.36		33,762,430.09		24,798,282.32

FEDERAL INTERMEDIATE CREDIT BANKS

TABLE 41.—*Statements of condition, Dec. 31, 1939*—Continued

	Wichita		Houston		Berkeley		Spokane	
ASSETS								
Loans and discounts:								
Production credit associations	$11,778,698.86		$11,271,524.26		$12,752,926.08		$18,833,048.24	
Other financing institutions	2,091,341.00		11,774,902.86		4,074,228.39		2,049,722.38	
Banks for cooperatives	2,253,741.01		437,935.99		4,275,286.36		1,644,493.85	
Cooperative associations								
Total loans and discounts	16,123,780.87		23,484,363.11		21,102,440.83		22,527,264.47	
Less reserve (other financing institutions)		$16,123,780.87		$23,484,363.11	250,000.00	$20,852,440.83	76,994.26	$22,450,270.21
Notes receivable	142,747.66		9,478.67				50,160.33	
Less reserve	142,546.41	201.25	9,253.67	225.00			50,160.33	
Cash:								
General funds		3,424,287.65		5,160,529.80		4,981,059.15		8,194,674.94
Held as collateral				33,516.68		5,127.78		255,314.81
U. S. Government obligations, direct and fully guaranteed (at cost or part, whichever is lower)		7,250,000.00		5,350,000.00		9,500,000.00		7,200,000.00
Accounts receivable		85.00		307.93		982.62		3.27
Accrued interest receivable:								
Loans and discounts:								
Production credit associations	32,121.95		21,999.93		71,490.51		126,805.34	
Other financing institutions	2,532.31		45.95		21,243.98		13,424.20	
Banks for cooperatives and cooperative associations	666.58		1,456.89		5,185.54		2,735.09	
Notes receivable			17.98				712.48	
Total	35,320.84		23,520.75		97,920.03		143,677.11	
Less reserve			17.98				712.48	
Net accrued interest receivable on loans, discounts, and notes receivable	35,320.84		23,502.77		97,920.03		142,964.63	

U. S. Government obligations, direct and fully guaranteed	17,835.85	53,156.69	12,044.20	35,546 97	10,935.77	108,855.80	18,156.15	161,120.78
Automobiles, furniture, fixtures, and equipment	32,999.65		27,855.85		28,443.97		33,018.93	
Less reserve	32,999.65		27,855.85		28,443.97		33,018.93	
Bank building					52,001.42			
Less reserve					52,001.42			
Prepaid and deferred expense		50.00				26.20		175.00
Other assets	56,008.16		14,261.08		11,184.94		50,625.93	
Less reserve	50,633.16	5,375.00	11,461.08	2,800.00		11,184.94	40,375.93	10,250.00
Total assets		26,856,936.46		34,067,289.49		35,459,677.32		38,271,809.01
LIABILITIES								
Unmatured consolidated debentures outstanding		$15,200,000.00		$23,350,000.00		$21,475,000.00		$25,425,000.00
Notes payable								
Trust accounts		350.00		1,137.78		74.25		94.73
Accounts payable				356.14				
Franchise tax payable		77,536.85		75,212.11		72,427.74		68,691.62
Liability for cash collateral				33,516.68		5,127.78		255,314.81
Deferred proceeds, loans and discounts								
Accrued interest payable (not due):								
Debentures	$61,601.02		$83,861.59		$89,037.82		$87,899.61	
Other		61,601.02		83,861.59		89,037.82		87,899.61
Interest collected, not earned				64,813.27				
Unamortized premium on outstanding debentures		14,941.88		28,204.97		21,962.63		18,582.92
Other liabilities		1,319.36		3,246.32		3,256.11		2,265.79
Capital stock paid in		6,000,000.00		7,000,000.00		7,000,000.00		7,000,000.00
Surplus paid in		3,600,000.00		800,000.00		6,400,000.00		3,800,000.00
Surplus earned		1,751,187.35		2,516,940.63		262,790.99		1,013,959.53
Reserve for contingencies		150,000.00		110,000.00		130,000.00		600,000.00
Total liabilities		26,856,936.46		34,067,289.49		35,459,677.32		38,271,809.01

FEDERAL INTERMEDIATE CREDIT BANKS

TABLE 42.—*Consolidated profit and loss statement for the year ended Dec. 31, 1939, and the year ended Dec. 31, 1938*

EARNINGS	Jan. 1 to Dec. 31, 1939		Jan. 1 to Dec. 31, 1938	
Interest:				
Loans and discounts	$3,700,947.23		$4,526,529.77	
U. S. Government obligations, direct and fully guaranteed	1,802,391.53		1,858,144.86	
Notes receivable	76,475.23		58,821.37	
Other interest earned	3,293.01		2,698.19	
Gross earnings		$5,583,107.00		$6,446,194.19
DEDUCTIONS FROM EARNINGS				
Interest on debentures (net)	852,533.65		1,132,503.03	
Other interest expense				
Operating expense	1,552,770.33		1,563,376.23	
Other charges to operations	107,501.43		226,077.49	
Total deductions from gross earnings		2,512,805.41		2,921,956.75
Net operating earnings		3,070,301.59		3,524,237.44
OTHER EARNINGS				
Discount on securities (amortized), and profit on securities sold	1,551,790.44		1,031,987.87	
Miscellaneous other additions	375.21		−13,653.41	
Total other earnings		1,552,165.65		1,018,334.46
OTHER DEDUCTIONS				
Premium written off on securities purchased	1,010,490.65		481,735.19	
Charge-offs (less recoveries)	+15,431.70		168,733.18	
Total other deductions		995,058.95		650,468.37
Net profit before adjustment of reserves		3,627,408.29		3,892,103.53
Adjustment of reserves (net)		+22,791.15		+502,267.09
Net profit after adjustment of reserves		3,650,199.44		4,394,370.62

BANKS FOR COOPERATIVES

TABLE 43.—*Applications received and approved during 1939, and pending, Dec. 31, 1939, and commitments and advances made during 1939, by banks*

Bank	Applications received	Applications approved		Applications pending, Dec. 31, 1939		Net commitments made	Advances made
		Number	Amount	Number	Amount		
Springfield	$4,810,350	118	$4,815,350	6	$57,500	$4,722,908	$3,846,721
Baltimore	7,462,333	66	5,794,283	6	87,900	4,356,183	4,666,008
Columbia	3,005,673	46	2,923,673	2	135,000	2,457,025	2,148,980
Louisville	5,870,941	75	5,039,690	19	624,151	6,166,685	6,229,677
New Orleans	13,172,030	64	13,181,230			11,352,853	10,930,568
St. Louis	3,300,449	192	3,175,349	9	84,700	2,635,161	2,504,206
St. Paul	3,836,041	165	3,695,825	12	146,916	2,115,809	2,380,477
Omaha	3,783,975	61	3,442,876	7	76,500	−178,809	1,180,280
Wichita	6,958,506	75	6,585,876	12	163,300	4,718,405	4,552,699
Houston	6,130,286	176	4,444,561	8	84,700	4,695,223	5,774,045
Berkeley	23,650,890	142	22,783,390	3	93,000	16,601,143	17,146,401
Spokane	5,722,556	86	5,771,423	3	59,000	4,962,921	4,986,469
Total	87,704,030	1,266	81,653,526	87	1,612,667	64,605,507	66,346,531
Central Bank	56,108,127	14	50,908,126			22,274,979	26,009,570
Eliminations: Participation loans						8,443,348	8,996,294
Grand total	143,812,157	1,280	132,561,652	87	1,612,667	78,437,138	83,359,807

TABLE 44.—*Commitments outstanding, Dec. 31, 1939, by banks and by type of commitment*

Bank	Commodity	Operating capital	Facility	Total
Springfield	$41,800	$1,458,929	$53,000	$1,553,729
Baltimore	301,467	1,166,779	157,142	1,625,388
Columbia	375,000	575,296	18,279	968,575
Louisville	288,951	3,272,384	126,145	3,687,480
New Orleans	2,087,000	1,761,073	13,506	3,861,579
St. Louis	56,679	563,170	14,700	634,549
St. Paul	344,722	669,222	58,638	1,072,582
Omaha	1,377,255	485,035	17,300	1,879,590
Wichita	840,638	589,780	546,760	1,977,178
Houston	792,500	459,400	77,485	1,329,385
Berkeley	879,579	2,336,195	136,733	3,352,507
Spokane	281,923	567,087	159,949	1,008,959
Total	7,667,514	13,904,350	1,379,637	22,951,501
Central Bank	17,590,668	7,469,359	55,800	25,115,827
Eliminations: Participation loans	2,434,292	709,350	55,800	3,199,442
Grand total	22,823,890	20,664,359	1,379,637	44,867,886

BANKS FOR COOPERATIVES

TABLE 45.—*Loans outstanding Dec. 31, 1939, by banks and by type of loan*

Bank	Commodity		Operating capital		Facility		Total	
	Number [1]	Amount	Number [1]	Amount	Number [1]	Amount	Number [1]	Amount
Springfield	3	$266,344	58	$2,968,427	38	$1,082,329	72	$4,317,100
Baltimore	7	668,415	43	2,743,614	43	1,047,131	64	4,459,160
Columbia			39	1,998,606	33	734,507	49	2,733,113
Louisville	5	926,188	127	2,416,190	55	370,689	140	3,713,067
New Orleans	1	3,413,000	30	4,684,577	47	2,509,247	67	10,606,824
St. Louis	1	282,312	117	1,378,356	110	883,637	181	2,544,305
St. Paul	10	417,627	186	1,440,118	222	2,019,266	320	3,877,011
Omaha	7	172,154	157	1,373,349	93	696,112	195	2,241,615
Wichita	6	2,180,737	69	859,272	97	2,534,709	128	5,574,718
Houston	1	37,936	73	1,100,549	154	1,752,805	176	2,891,290
Berkeley	21	4,632,041	87	4,206,199	97	4,152,143	128	12,990,383
Spokane	10	1,591,053	53	1,745,627	91	3,454,268	104	6,790,948
Total	72	14,587,807	1,039	26,914,884	1,080	21,236,843	[2] 1,624	62,739,534
Central Bank	6	9,577,551	13	9,369,927	8	2,156,567	17	21,104,045
Eliminations: Participation loans	2	3,215,708	4	3,958,167	3	417,362	7	7,591,237
Grand total	76	20,949,650	1,048	32,326,644	1,085	22,976,048	[2] 1,634	76,252,342

[1] Represents number of cooperative associations having loans outstanding.

[2] The total number of loans outstanding is less than the sum of the 3 types of loans, owing to the fact that some associations have more than 1 type of loan outstanding.

TABLE 46.—*Applications received, net commitments made, advances, and loans outstanding for specified periods*

Period	Applications received	Net commitments made	Advances	Loans outstanding at end of period
Organization through Dec. 31, 1934	$133,149,065	$79,229,991	$67,515,391	$27,850,593
1935	187,987,258	93,540,710	66,347,752	50,013,329
1936	142,261,356	91,764,303	81,294,454	69,647,241
1937	170,225,602	105,339,129	97,584,498	87,633,166
1938	158,018,830	87,604,047	94,945,530	87,496,341
1939	143,812,157	78,437,138	83,359,807	76,252,342
1939:				
January	9,478,752	8,866,961	3,814,505	80,266,415
February	7,883,786	7,352,668	2,785,870	73,692,199
March	22,786,998	6,249,662	4,578,355	65,783,250
April	12,873,446	33,799	4,030,911	61,362,961
May	6,629,765	4,542,869	5,052,489	60,465,217
June	16,330,212	[1] −6,426,101	4,857,786	59,576,528
July	6,986,054	11,479,114	7,614,722	62,123,894
August	15,827,553	7,252,604	8,205,937	61,403,916
September	18,092,087	11,165,662	10,118,011	65,159,591
October	7,536,723	9,585,406	12,698,737	70,422,465
November	12,577,063	9,593,426	10,072,527	73,120,004
December	6,809,718	8,741,068	9,529,957	76,252,342

[1] Reflects cancelations and adjustments amounting to $28,288,656.

TABLE 47.—*Advances made in 1939, by commodities, and loans outstanding Dec. 31, 1939, by type of loan and by commodities*

Commodity	Advances	Type of loan outstanding							
		Commodity		Operating		Facility		Total	
		Number[1]	Amount	Number[1]	Amount	Number[1]	Amount	Number[1]	Amount
Farm products:									
Fruits and vegetables	$21,985,032	30	$5,531,042	144	$7,336,406	142	$4,749,245	199	$17,616,693
Wine and brandy	6,201,723	12	1,908,932	14	1,324,783	13	1,328,409	14	4,562,124
Dairy	5,295,889	4	72,215	92	2,840,136	174	3,856,143	190	6,768,494
Poultry	1,965,031	1	15,689	22	1,811,699	21	437,695	29	2,265,083
Grain	13,018,503	16	5,808,360	224	2,928,784	219	2,090,856	359	10,828,000
Tobacco	1,412,942	3	124,715	3	194,305	2	98,449	8	417,469
Sugar	2,798,572			7	1,180,707	7	2,333,424	8	3,514,131
Nuts	438,150			3	328,788	2	35,400	5	364,188
Wool and mohair	4,177,605			2	329,381	1	5,425	3	334,806
Cotton	12,433,548	3	6,557,092	64	3,525,108	198	1,745,446	214	11,827,646
Livestock	972,390			10	230,222	3	314,681	12	544,903
Other	2,087,280	6	776,969	56	1,470,800	33	224,264	68	2,472,033
Total farm products	72,786,665	75	20,795,014	641	23,501,119	815	17,219,437	1,109	61,515,570
Farm supply:									
General	8,174,401	1	154,636	169	7,383,683	85	841,584	185	8,379,903
Petroleum products	1,316,579			182	825,374	103	422,683	219	1,248,057
Total farm supply	9,490,980	1	154,636	351	8,209,057	188	1,264,267	404	9,627,960
Farm business services:									
Irrigation	268,100			15	101,024	36	3,538,240	43	3,639,264
Insurance	532,303			26	409,682			26	409,682
Warehousing	141,900			4	42,770	11	441,508	11	484,278
Farmers' markets	11,200			4	53,700	6	274,685	7	328,385
Other	128,659			7	9,292	29	237,911	34	247,203
Total farm business services	1,082,162			56	616,468	82	4,492,344	121	5,108,812
Grand total	83,359,807	76	20,949,650	1,048	32,326,644	1,085	22,976,048	[2] 1,634	76,252,342

[1] Represents number of cooperative associations having loans outstanding.

[2] The total number of loans outstanding is less than the sum of the 3 types of loans, owing to the fact that some associations have more than 1 type of loan outstanding.

DISTRICT BANKS FOR COOPERATIVES

TABLE 48.—*Loans outstanding Dec. 31, 1939, by States*

District and State	Loans outstanding	
	Number [1]	Amount [2]
District 1:		
Maine	12	$542,517
New Hampshire	3	16,680
Vermont	4	495,655
Massachusetts	7	1,236,000
Rhode Island	1	56,000
Connecticut	7	123,472
New York	30	1,747,953
New Jersey	8	98,823
Total	72	4,317,100
District 2:		
Pennsylvania	25	811,484
Delaware	1	6,884
Maryland	13	843,756
Virginia	19	2,368,829
West Virginia	3	18,738
Puerto Rico	3	409,469
Total	64	4,459,160
District 3:		
North Carolina	9	418,797
South Carolina	1	3,200
Georgia	11	268,976
Florida	28	2,042,140
Total	49	2,733,113
District 4:		
Ohio	62	1,438,391
Indiana	64	1,863,123
Kentucky	8	284,495
Tennessee	6	127,058
Total	140	3,713,067
District 5:		
Alabama	19	340,652
Mississippi	37	6,955,199
Louisiana	11	3,310,973
Total	67	10,606,824
District 6:		
Illinois	113	$1,000,564
Missouri	63	959,849
Arkansas	5	583,892
Total	181	2,544,305
District 7:		
Michigan	40	1,249,469
Wisconsin	79	1,103,546
Minnesota	111	1,115,800
North Dakota	90	408,196
Total	320	3,877,011
District 8:		
Iowa	95	1,167,685
South Dakota	37	293,655
Nebraska	53	542,249
Wyoming	8	233,922
Total	193	2,237,511
District 9:		
Kansas	50	1,020,431
Oklahoma	48	2,557,133
Colorado	24	1,953,686
New Mexico	5	25,662
Total	127	5,556,912
District 10: Texas	177	2,909,096
District 11:		
Arizona	4	75,900
Utah	10	1,008,600
Nevada	2	41,034
California	112	11,864,849
Total	128	12,990,383
District 12:		
Montana	8	65,788
Idaho	20	631,561
Washington	54	2,991,884
Oregon	24	3,105,819
Total	106	6,795,052
Grand total	1,624	62,739,534

[1] Represents number of cooperative associations having loans outstanding.

[2] Includes participations by the Central Bank for Cooperatives.

NOTE.—Totals by States for some districts do not agree with corresponding district totals on table 45 because the banks have reported outstanding loans for associations whose operations extend into States outside their own districts.

BANKS FOR COOPERATIVES

TABLE 49.—*Statements of condition, Dec. 31, 1939*

	Consolidated statement, district banks		Central Bank		Consolidated statement including Central Bank [1]	
ASSETS						
Loans:						
Commodity	$14,587,806.84		$9,577,550.69		$20,949,649.66	
Operating capital	26,914,883.92		9,369,927.47		32,326,644.39	
Facility	21,236,843.81		2,156,566.56		22,976,048.36	
Total	62,739,534.57		21,104,044.72		76,252,342.41	
Less participation certificates outstanding:						
Operating capital	3,235,667.00		722,500.00			
Facility	417,362.01					
Total	3,653,029.01		722,500.00			
Net loans outstanding	59,086,505.56		20,381,544.72		76,252,342.41	
Less reserve	2,370,620.43	$56,715,885.13	1,500,000.00	$18,881,544.72	3,870,620.43	$72,381,721.98
Notes purchased from cooperatives—Guaranteed by Commodity Credit Corporation				2,570,763.66		2,570,763.66
Cash:						
General funds	7,702,637.63		5,791,436.77		13,494,074.40	
Held as collateral	49,633.15	7,752,270.78		5,791,436.77	49,633.15	13,543,707.55
U. S. Government obligations, direct and fully guaranteed:						
Par value	50,654,850.00		35,485,000.00		86,139,850.00	
Unamortized premium (net)	1,053,824.63	51,708,674.63	971,348.70	36,456,348.70	2,025,173.33	88,165,023.33
Consolidated Federal intermediate credit bank debentures:						
Par value	5,050,000.00		1,200,000.00		6,250,000.00	
Unamortized premium	7,081.91	5,057,081.91	282.76	1,200,282.76	7,364.67	6,257,364.67

See footnotes at end of table.

BANKS FOR COOPERATIVES

TABLE 49.—*Statements of condition, Dec. 31, 1939*—Continued

	Consolidated statement, district banks		Central Bank		Consolidated statement including Central Bank	
ASSETS—Continued						
Loans in process of liquidation	$261,807.00				$261,807.00	
Less reserve	202,031.24	$59,775.76			202,031.24	$59,775.76
Assets acquired in liquidation of loans	175,425.30				175,425.30	
Less reserve	81,621.77	93,803.53			81,621.77	93,803.53
Accounts receivable		26,082.18		$1,973.94		26,948.84
Notes receivable, sales contracts, etc	81,774.43				81,774.43	
Less reserve	18,000.00	63,774.43			18,000.00	63,774.43
Accrued interest receivable:						
Loans to cooperative associations	539,941.02		$79,954.11		619,895.13	
Less reserve for delinquent interest on loans	93,875.72		290.10		94,165.82	
Net	446,065.30		79,664.01		525,729.31	
Notes purchased from cooperatives—Guaranteed by Commodity Credit Corporation			59,717.84		59,717.84	
U. S. Government obligations, direct and fully guaranteed	187,370.91		204,407.63		391,778.54	
Consolidated Federal intermediate credit bank debentures	6,737.48		2,213.90		8,951.38	
Notes receivable, sales contracts, etc	2,104.45				2,104.45	
Less reserve	1,604.14				1,604.14	
Net	500.31	640,674.00		346,003.38	500.31	986,677.38
Automobiles, furniture, fixtures, and equipment (net)		26,004.00		1.00		26,005.00
Bank building [2]		40,858.26				40,858.26
Prepaid and deferred expense		907.78				907.78
Other assets		40,659.20		7,757.99		45,333.08
Total assets		122,226,451.59		65,256,112.92		184,262,665.25

LIABILITIES						
Loans rediscounted with Federal intermediate credit banks		$13,189,068.02		$4,666,994.88		$17,856,062.90
Liability on rediscounted commodity loans of other banks for cooperatives				3,215,707.87		
Liability for cash collateral		49,633.15				49,633.15
Accounts payable		10,164.83				9,057.55
Trust accounts		78,436.90				78,436.90
Accrued interest payable on loans rediscounted with Federal intermediate credit banks		24,059.23		17,219.52		41,278.75
Other liabilities		11,603.46		4,336.01		12,855.36
Capital stock and guaranty fund:						
Capital stock:						
U. S. Government	$99,000,000.00		$50,000,000.00		$149,000,000.00	
Cooperatives	2,943,800.00		435,400.00		3,379,200.00	
Guaranty fund: Cooperatives	108,100.00	102,051,900.00		50,435,400.00	108,100.00	152,487,300.00
Surplus earned		6,811,586.00		6,916,454.64		13,728,040.64
Total liabilities		122,226,451.59		65,256,112.92		184,262,665.25

[1] This statement reflects adjustments necessary to eliminate items which are included in both the "Consolidated statement, district banks" and the "Central Bank" statement.
[2] This represents the investment in banking quarters by the Berkeley Bank for Cooperatives.

NOTE.—Total commitments outstanding, Dec. 31, 1939, amounted to $44,867,885.67.

FEDERAL FARM MORTGAGE CORPORATION

TABLE 50.—*Land Bank Commissioner loans closed and outstanding 1933–39*

Year	Loans closed		Loans outstanding, Dec. 31	
	Number	Amount	Number	Amount
1933	[1] 44,039	[1] $70,812,112	43,994	$70,738,461
1934	306,354	553,136,316	347,299	616,825,108
1935	91,004	196,395,349	431,205	794,726,418
1936	38,929	77,257,795	455,082	836,778,547
1937	21,873	40,020,173	455,291	812,749,284
1938	17,453	29,395,145	448,080	752,850,796
1939	16,423	27,417,350	439,076	690,879,811
Total	536,075	994,434,240		

[1] May 12, 1933, through Dec. 31, 1933.

TABLE 51.—*Land Bank Commissioner loans closed during 1939 and outstanding Dec. 31, 1939, by States*

District and State	Loans closed during 1939		Loans outstanding, Dec. 31, 1939	
	Number	Amount	Number	Amount
District 1:				
Maine	35	$48,000	2,150	$3,532,801
New Hampshire	39	55,900	518	750,873
Vermont	65	86,400	1,172	1,441,017
Massachusetts	141	283,300	2,237	3,897,050
Rhode Island	23	45,200	321	599,300
Connecticut	187	368,300	1,689	3,001,673
New York	578	926,200	8,047	12,984,943
New Jersey	210	414,500	2,456	4,583,639
Total	1,278	2,227,800	18,590	30,791,296
District 2:				
Pennsylvania	177	239,200	5,325	6,907,168
Delaware	15	18,900	273	412,200
Maryland	70	106,800	1,899	3,302,315
Virginia	147	207,200	4,803	6,452,311
West Virginia	72	101,600	2,545	2,586,180
Puerto Rico	58	186,900	618	1,542,467
Total	539	860,600	15,463	21,202,641
District 3:				
North Carolina	633	788,240	12,947	14,810,362
South Carolina	279	353,680	9,011	10,217,695
Georgia	751	843,149	14,633	15,334,301
Florida	166	243,850	5,285	7,593,000
Total	1,829	2,228,919	41,876	47,955,358
District 4:				
Ohio	512	797,800	13,304	19,084,880
Indiana	684	1,018,300	15,498	20,803,775
Kentucky	307	503,900	10,446	13,459,323
Tennessee	494	663,300	10,687	11,880,572
Total	1,997	2,983,300	49,935	65,228,550

FEDERAL FARM MORTGAGE CORPORATION—Continued

TABLE 51.—*Land Bank Commissioner loans closed during 1939 and outstanding Dec. 31, 1939, by States*—Continued

District and State	Loans closed during 1939		Loans outstanding, Dec. 31, 1939	
	Number	Amount	Number	Amount
District 5:				
Alabama	864	$704,100	10,975	$8,243,245
Mississippi	489	538,231	10,756	7,607,656
Louisiana	251	352,900	4,732	4,476,837
Total	1,604	1,595,231	26,463	20,327,738
District 6:				
Illinois	874	2,096,700	16,481	37,324,625
Missouri	317	455,700	13,413	18,491,436
Arkansas	183	274,600	6,572	6,431,002
Total	1,374	2,827,000	36,466	62,247,063
District 7:				
Michigan	283	377,500	18,443	21,921,948
Wisconsin	208	325,100	22,659	42,887,206
Minnesota	334	573,500	23,305	42,360,976
North Dakota			17,039	27,863,433
Total	825	1,276,100	81,446	135,033,563
District 8;:				
Iowa	845	2,021,500	21,207	52,641,048
South Dakota	122	264,800	10,584	18,550,991
Nebraska	619	1,151,700	15,571	32,721,182
Wyoming	117	276,800	2,829	4,284,850
Total	1,703	3,714,800	50,191	108,198,071
District 9:				
Kansas	695	981,700	20,175	37,034,974
Oklahoma	431	541,400	12,714	15,486,749
Colorado	319	531,800	6,270	9,672,408
New Mexico	129	215,100	1,979	2,776,218
Total	1,574	2,270,000	41,138	64,970,349
District 10: Texas	1,693	2,796,650	31,636	46,095,661
District 11:				
Arizona	102	295,900	1,153	2,323,588
Utah	35	72,200	3,411	5,277,386
Nevada	4	14,300	270	705,257
California	745	1,942,300	19,710	43,768,047
Total	886	2,324,700	24,544	52,074,278
District 12:				
Montana	229	426,650	5,471	10,239,848
Idaho	307	532,750	5,199	8,802,549
Washington	292	707,750	5,473	8,525,426
Oregon	293	645,100	5,185	9,187,420
Total	1,121	2,312,250	21,328	36,755,243
Grand total	16,423	27,417,350	439,076	690,879,811

FEDERAL FARM MORTGAGE CORPORATION

TABLE 52.—*First and second mortgage Land Bank Commissioner loans closed during 1939, and second mortgage loans as a percent of the total, by districts*

District	First mortgage loans		Second mortgage loans		Total first and second mortgage loans		Second mortgage loans as a percent of total	
	Number	Amount	Number	Amount	Number	Amount	Number	Amount
Springfield	303	$579,500	975	$1,648,300	1,278	$2,227,800	76.3	74.0
Baltimore	150	258,500	389	602,100	539	860,600	72.2	70.0
Columbia	1,019	1,105,774	810	1,123,145	1,829	2,228,919	44.3	50.4
Louisville	653	1,037,300	1,344	1,946,000	1,997	2,983,300	67.3	65.2
New Orleans	801	650,250	803	944,981	1,604	1,595,231	50.1	59.2
St. Louis	399	771,900	975	2,055,100	1,374	2,827,000	71.0	72.7
St. Paul	197	320,800	628	955,300	825	1,276,100	76.1	74.9
Omaha	362	846,500	1,341	2,868,300	1,703	3,714,800	78.7	77.2
Wichita	452	713,000	1,122	1,557,000	1,574	2,270,000	71.3	68.6
Houston	637	975,550	1,056	1,821,100	1,693	2,796,650	62.4	65.1
Berkeley	259	646,200	627	1,678,500	886	2,324,700	70.8	72.2
Spokane	334	557,750	787	1,754,500	1,121	2,312,250	70.2	75.9
Total	5,566	8,463,024	10,857	18,954,326	16,423	27,417,350	66.1	69.1

TABLE 53.—*Percentage of Land Bank Commissioner loan proceeds used to refinance indebtedness from Jan. 1, 1939 through Dec. 31, 1939, classified according to type of indebtedness and class of creditor, by States* [1]

District and State	First and junior mortgages held by—				Other indebtedness owed to—			Total
	Life insurance companies	Commercial banks	Joint stock land banks	Others	Commercial banks	Tax authorities	Other creditors	
District 1:								
Maine	----	16.8	----	39.2	2.4	3.6	21.1	83.1
New Hampshire	----	5.7	----	34.2	----	.7	22.5	63.1
Vermont	----	14.3	----	36.7	.5	.4	15.1	67.0
Massachusetts	----	6.3	----	30.5	.5	2.3	20.9	60.5
Rhode Island	----	5.2	----	37.2	4.8	5.3	16.5	69.0
Connecticut	----	5.8	----	36.7	.3	1.8	21.8	66.4
New York	----	4.6	1.4	36.6	1.3	1.1	20.7	65.7
New Jersey	----	4.9	.4	42.8	.8	2.5	17.8	69.2
Total	----	5.7	.6	37.1	1.0	1.7	20.2	66.3
District 2:								
Pennsylvania	----	10.8	2.5	32.8	7.3	.6	11.4	65.4
Delaware	----	7.4	----	26.1	13.8	----	7.7	55.0
Maryland	1.9	5.8	----	40.6	4.5	.6	9.1	62.5
Virginia	3.8	13.8	3.2	29.5	13.8	.2	9.1	73.4
West Virginia	----	12.2	8.6	33.9	9.4	(3)	11.9	76.0
Total [2]	1.5	11.0	3.1	33.0	9.4	.4	10.3	68.7

See footnotes at end of table.

FEDERAL FARM MORTGAGE CORPORATION

TABLE 53.—*Percentage of Land Bank Commissioner loan proceeds used to refinance indebtedness from Jan. 1, 1939 through Dec. 31, 1939, classified according to type of indebtedness and class of creditor, by States*—Continued

District and State	First and junior mortgages held by—				Other indebtedness owed to—			Total
	Life insurance companies	Commercial banks	Joint stock land banks	Others	Commercial banks	Tax authorities	Other creditors	
District 3:								
North Carolina	5.0	9.1	8.5	39.5	3.8	2.2	10.9	79.0
South Carolina	5.3	5.4	6.9	35.4	1.7	2.2	8.4	65.3
Georgia	8.0	14.2	3.6	36.5	2.7	2.2	7.1	74.3
Florida	----	13.8	----	49.4	3.1	1.0	12.0	79.3
Total	5.6	10.9	5.4	38.9	3.0	2.1	9.2	75.1
District 4:								
Ohio	4.2	14.4	2.4	24.0	12.9	.5	8.8	67.2
Indiana	4.4	8.4	2.3	24.1	11.1	.4	8.9	59.6
Kentucky	3.1	12.4	.7	34.1	12.8	.2	10.3	73.6
Tennessee	5.8	15.1	----	38.6	8.8	1.8	10.1	80.2
Total	4.5	12.2	1.5	29.0	11.3	.7	9.4	68.6
District 5:								
Alabama	5.4	11.8	1.8	44.2	4.4	.1	7.4	75.1
Mississippi	7.4	16.0	3.6	41.5	3.8	.5	6.2	79.0
Louisiana	5.4	19.0	----	41.3	2.2.	.2	13.4	81.5
Total	6.1	14.8	2.0	42.7	3.7	.2	8.3	77.8
District 6:								
Illinois	9.9	5.6	2.7	30.8	2.8	.2	6.5	58.5
Missouri	12.4	13.3	1.7	33.0	6.3	.3	5.9	72.9
Arkansas	5.5	10.9	10.5	41.5	.7	.8	6.2	76.1
Total	9.9	7.3	3.3	32.2	3.2	.3	6.4	62.6
District 7;								
Michigan	3.2	9.2	.2	30.8	2.1	1.0	10.0	56.5
Wisconsin	1.3	8.2	----	46.4	2.1	.2	10.1	68.3
Minnesota	5.5	4.5	.2	29.0	2.3	.3	9.8	51.6
North Dakota	----	----	----	----	----	----	----	----
Total	3.8	6.8	.1	34.0	2.2	.5	9.9	57.3
District 8:								
Iowa	12.1	4.8	2.2	23.3	5.3	(3)	11.0	58.7
South Dakota	6.2	5.3	1.6	31.1	4.5	5.4	14.7	68.8
Nebraska	6.0	8.1	.2	38.3	7.7	2.0	11.3	73.6
Wyoming	----	3.9	3.6	45.8	7.5	.2	12.8	73.8
Total	8.9	5.8	1.6	30.2	6.2	1.0	11.5	65.2
District 9:								
Kansas	16.4	12.9	2.3	27.8	10.4	1.2	6.7	77.7
Oklahoma	14.8	7.8	.1	40.3	4.8	.8	5.4	74.0
Colorado	5.3	11.4	4.5	43.0	6.2	2.0	6.0	78.4
New Mexico	1.7	6.2	----	47.3	8.5	.4	9.8	73.9
Total	12.0	10.7	2.1	36.2	7.9	1.2	6.5	76.6

See footnotes at end of table.

FEDERAL FARM MORTGAGE CORPORATION

TABLE 53.—*Percentage of Land Bank Commissioner loan proceeds used to refinance indebtedness from Jan. 1, 1939 through Dec. 31, 1939, classified according to type of indebtedness and class of creditor, by States*—Continued

District and State	First and junior mortgages held by—				Other indebtedness owed to—			Total
	Life insurance companies	Commercial banks	Joint stock land banks	Others	Commercial banks	Tax-authorities	Other creditors	
District 10: Texas	10.9	5.4	4.5	28.3	3.8	1.2	4.3	58.4
District 11:								
Arizona	8.9	16.2	.....	36.7	5.3	2.3	10.4	79.8
Utah	.....	31.4	.....	41.4	5.4	.2	3.7	82.1
Nevada	.....	35.6	.....	.....	.....	.....	10.5	46.1
California	2.3	14.7	.....	43.7	6.6	1.2	5.4	73.9
Total	3.1	15.5	.....	42.5	6.4	1.3	6.0	74.8
District 12:								
Montana	3.5	14.7	1.9	47.3	6.9	3.0	10.7	88.0
Idaho	9.7	12.3	.3	46.0	6.3	2.6	10.8	88.0
Washington	12.6	10.6	1.4	41.5	6.6	1.9	10.4	85.0
Oregon	8.6	9.0	5.7	43.9	6.6	2.7	9.0	85.5
Total	9.1	11.3	2.4	44.3	6.6	2.5	10.2	86.4
Grand total [2]	6.9	9.4	2.3	35.1	5.5	1.1	9.2	69.5

[1] For same information on Federal land bank loans, see table 7. For percentage of loan proceeds used for all purposes, including refinancing, see table 4.

[2] Excluding Puerto Rico.

[3] Less than 0.1 per cent.

TABLE 54.—*Collection and other disposition of matured items due from borrowers during 1939, by districts*

District	Total delinquent installments, advances, etc., Jan. 1, 1939	Total maturities and advances during 1939	Total amount collectible	Disposition				Percent delinquent, Dec. 31, 1939
				Percent collected	Percent extended or deferred	Percent reamortized	Percent charged off or transferred to foreclosure or suspense	
Springfield	$1,095,628	$3,703,795	$4,799,423	61.7	2.5	1.1	5.9	28.8
Baltimore	395,121	2,996,736	3,391,857	82.3	.6	2.3	3.5	11.3
Columbia	1,560,694	6,965,282	8,525,976	52.9	12.3	8.6	2.0	24.2
Louisville	898,517	8,695,101	9,593,618	84.9	2.8	.9	1.9	9.5
New Orleans	1,546,105	3,444,537	4,990,642	54.9	10.8	2.2	2.0	30.1
St. Louis	1,230,959	8,025,074	9,256,033	81.9	7.3	.5	2.5	7.8
St. Paul	10,038,292	24,290,188	34,328,480	33.6	21.9	3.4	3.5	37.6
Omaha	6,407,352	17,829,401	24,236,753	38.2	14.0	16.2	7.6	24.0
Wichita	4,243,290	9,306,461	13,549,751	44.7	5.8	7.8	6.6	35.1
Houston	1,340,367	7,167,155	8,507,522	69.3	5.4	7.7	2.3	15.3
Berkeley	2,002,727	7,254,473	9,257,200	64.5	3.1	3.0	2.4	27.0
Spokane	2,027,164	7,048,777	9,075,941	49.4	15.3	9.3	2.3	23.7
Total	32,786,216	106,726,980	139,513,196	51.6	11.8	6.5	4.0	26.1

FEDERAL FARM MORTGAGE CORPORATION

TABLE 55.—*Principal payments, loans paid off prior to maturity, and loans closed during 1939*

District	Principal payments	Loans paid off prior to maturity	Total payments on principal	Loans closed
Springfield	$1,887,967	$460,549	$2,348,516	$2,227,800
Baltimore	1,932,162	757,455	2,689,617	860,600
Columbia	2,612,332	1,042,260	3,654,592	2,228,919
Louisville	6,071,231	2,972,210	9,043,441	2,983,300
New Orleans	1,739,824	662,736	2,402,560	1,595,231
St. Louis	5,295,688	1,930,811	7,226,499	2,827,000
St. Paul	7,256,925	1,200,748	8,457,673	1,276,100
Omaha	6,471,716	1,821,958	8,293,674	3,714,800
Wichita	3,801,729	1,137,836	4,939,565	2,270,000
Houston	4,295,772	1,774,278	6,070,050	2,796,650
Berkeley	4,025,877	929,611	4,955,488	2,324,700
Spokane	3,120,733	802,949	3,923,682	2,312,250
Total	48,511,956	15,493,401	64,005,357	27,417,350

TABLE 56.—*Classification of mortgage loans outstanding Dec. 31, 1939, by States*

District and State	Number of loans outstanding	Loans classified as not delinquent				Classified as delinquent (loans with matured installments unpaid and loans with delinquent extensions)	
		With all matured installments paid in full		With all matured installments extended, with no delinquency in extensions			
		Number	Percent	Number	Percent	Number	Percent
District 1:							
Maine	2,150	969	45.1			1,181	54.9
New Hampshire	518	408	78.8			110	21.2
Vermont	1,172	845	72.1			327	27.9
Massachusetts	2,237	1,737	77.6			500	22.4
Rhode Island	321	243	75.7			78	24.3
Connecticut	1,689	1,357	80.3			332	19.7
New York	8,047	6,032	75.0			2,015	25.0
New Jersey	2,456	1,823	74.2			633	25.8
Total	18,590	13,414	72.2			5,176	27.8
District 2:							
Pennsylvania	5,325	4,644	87.2			681	12.8
Delaware	273	234	85.7			39	14.3
Maryland	1,899	1,537	80.9			362	19.1
Virginia	4,803	3,951	82.3			852	17.7
West Virginia	2,545	2,205	86.6			340	13.4
Puerto Rico	618	561	90.8	16	2.6	41	6.6
Total	15,463	13,132	84.9	16	.1	2,315	15.0
District 3:							
North Carolina	12,947	9,117	70.4	81	.6	3,749	29.0
South Carolina	9,011	5,690	63.1	45	.5	3,276	36.4
Georgia	14,633	9,824	67.1	74	.5	4,735	32.4
Florida	5,285	4,508	85.3	117	2.2	660	12.5
Total	41,876	29,139	69.6	317	.7	12,420	29.7

See footnotes at end of table.

FEDERAL FARM MORTGAGE CORPORATION

TABLE 56.—*Classification of mortgage loans outstanding Dec. 31, 1939, by States*—Continued

District and State	Number of loans outstanding	Loans classified as not delinquent				Classified as delinquent (loans with matured installments unpaid and loans with delinquent extensions)	
		With all matured installments paid in full		With all matured installments extended, with no delinquency in extensions			
		Number	Percent	Number	Percent	Number	Percent
District 4:							
Ohio	13,304	11,510	86.5	2	(1)	1,792	13.5
Indiana	15,498	14,088	90.9	26	.2	1,384	8.9
Kentucky	10,446	8,569	82.0	40	.4	1,837	17.6
Tennessee	10,687	9,243	86.5	23	.2	1,421	13.3
Total	49,935	43,410	86.9	91	.2	6,434	12.9
District 5:							
Alabama	10,975	6,053	55.1	106	1.0	4,816	43.9
Mississippi	10,756	5,540	51.5	196	1.8	5,020	46.7
Louisiana	4,732	3,244	68.6	28	.6	1,460	30.8
Total	26,463	14,837	56.1	330	1.2	11,296	42.7
District 6:							
Illinois	16,481	14,595	88.6	72	.4	1,814	11.0
Missouri	13,413	11,422	85.2	259	1.9	1,732	12.9
Arkansas	6,572	5,921	90.1	9	.1	642	9.8
Total	36,466	31,938	87.6	340	.9	4,188	11.5
District 7:							
Michigan	18,443	14,878	80.7	47	.2	3,518	19.1
Wisconsin	22,659	13,546	59.8	219	1.0	8,894	39.2
Minnesota	23,305	16,045	68.9	50	.2	7,210	30.9
North Dakota	17,039	2,342	13.8	311	1.8	14,386	84.4
Total	81,446	46,811	57.5	627	.8	34,008	41.7
District 8:							
Iowa	21,207	17,508	82.6	190	.9	3,509	16.5
South Dakota	10,584	5,208	49.2	663	6.3	4,713	44.5
Nebraska	15,571	7,272	46.7	329	2.1	7,970	51.2
Wyoming	2,829	1,932	68.3	6	.2	891	31.5
Total	50,191	31,920	63.6	1,188	2.4	17,083	34.0
District 9:							
Kansas	20,175	9,951	49.3	222	1.1	10,002	49.6
Oklahoma	12,714	9,161	72.0	37	.3	3,516	27.7
Colorado	6,270	4,075	65.0	15	.2	2,180	34.8
New Mexico	1,979	1,581	79.9	5	.2	393	19.9
Total	41,138	24,768	60.2	279	.7	16,091	39.1
District 10: Texas	31,636	26,105	82.5	168	.5	5,363	17.0
District 11:							
Arizona	1,153	904	78.4	----	----	249	21.6
Utah	3,411	2,074	60.8	----	----	1,337	39.2
Nevada	270	206	76.3	----	----	64	23.7
California	19,710	14,331	72.7	----	----	5,379	27.3
Total	24,544	17,515	71.4	----	----	7,029	28.6

See footnote at end of table.

FEDERAL FARM MORTGAGE CORPORATION

TABLE 56—*Classification of mortgage loans outstanding Dec. 31, 1939, by States*—Continued

District and State	Number of loans outstanding	Loans classified as not delinquent				Classified as delinquent (loans with matured installments unpaid and loans with delinquent extensions)	
		With all matured installments paid in full		With all matured installments extended, with no delinquency in extensions			
		Number	Percent	Number	Percent	Number	Percent
District 12:							
Montana	5,471	3,444	62.9	157	2.9	1,870	34.2
Idaho	5,199	3,771	72.5	8	.2	1,420	27.3
Washington	5,473	4,287	78.3	29	.5	1,157	21.2
Oregon	5,185	4,034	77.8	30	.6	1,121	21.6
Total	21,328	15,536	72.8	224	1.1	5,568	26.1
Grand total	439,076	308,525	70.3	3,580	.8	126,971	28.9

[1] Less than 0.1 percent.

TABLE 57.—*Interest reduction granted borrowers, for which reimbursement is obtained from the Secretary of the Treasury*

District	1939	Total, 1937–39	District	1939	Total, 1937–39
Springfield	$311,352	$754,998	Omaha	$1,175,308	$2,994,661
Baltimore	226,973	585,405	Wichita	674,025	1,728,987
Columbia	502,354	1,453,296	Houston	495,816	1,170,074
Louisville	704,689	1,798,483	Berkeley	536,332	1,321,258
New Orleans	211,713	667,948	Spokane	387,269	958,396
St. Louis	664,207	1,683,643			
St. Paul	1,450,032	3,808,235	Total	7,340,070	18,925,384

TABLE 58.—*Real estate, sheriffs' certificates, etc., acquired and disposed of during 1939, by districts*

District	Acquisitions		Disposals				Consideration as a percent of investment
			Number		Investment [1]	Consideration [1]	
	Number	Investment [1]	Whole	Part			
Springfield	251	$1,138,480	240	10	$1,172,505	$875,784	74.7
Baltimore	253	1,017,751	196	17	782,328	626,946	80.1
Columbia	448	1,210,479	513	85	1,313,817	1,059,041	80.6
Louisville	200	664,183	235	35	781,965	690,409	88.3
New Orleans	319	507,117	318	40	541,512	444,561	82.1
St. Louis	356	1,139,838	475	27	1,626,430	1,143,269	70.3
St. Paul	2,175	9,022,566	1,671	71	8,320,524	5,084,754	61.1
Omaha	2,101	12,530,500	1,579	74	9,958,934	7,027,898	70.6
Wichita	1,048	4,340,871	599	26	2,578,707	1,693,777	65.7
Houston	237	838,494	245	9	825,145	711,114	86.2
Berkeley	169	828,035	181	10	885,422	666,010	75.2
Spokane	230	897,552	154	20	611,294	501,780	82.1
Total	7,787	34,135,866	6,406	424	29,398,583	20,525,343	69.8

[1] Includes amount of prior liens.

FEDERAL FARM MORTGAGE CORPORATION

TABLE 59.—*Real estate, sheriffs' certificates, etc., held, Dec. 31, 1939, by districts*

District	Held not subject to prior liens				Held subject to prior liens						Total			
	Farms owned outright		Sheriffs' certificates, etc.		Farms			Sheriffs' certificates, etc.			Farms		Sheriffs' certificates, etc.	
	Number	Investment	Number	Investment	Number	Investment [1]	Amount of prior liens	Number	Investment [1]	Amount of prior liens	Investment [1]	Carrying value [1]	Investment [1]	Carrying value [1]
Springfield	101	$330,709			48	$343,893	$137,284				$674,602	$372,087		
Baltimore	133	358,756			80	596,193	283,656				954,949	563,486		
Columbia	71	139,035			69	422,829	162,538				561,864	262,643		
Louisville	60	169,098	3	$3,091	59	403,224	182,847				572,322	326,580	$3,091	$2,627
New Orleans	110	133,568	67	76,232	46	185,540	73,451	28	$96,164	$44,984	319,108	172,291	172,396	101,395
St. Louis	100	290,272	41	153,278	25	213,374	102,280	11	124,606	58,096	503,646	319,984	277,884	173,054
St. Paul	1,818	4,696,620	852	2,306,629	261	2,069,780	952,159	475	3,284,470	1,662,637	6,766,400	3,441,368	5,591,099	2,885,151
Omaha	1,328	3,798,086	445	1,451,060	583	5,578,243	3,088,909	170	1,648,981	942,646	9,376,329	5,443,723	3,100,041	1,842,302
Wichita	720	1,613,574	425	1,224,847	266	2,077,602	943,942	333	2,783,074	1,303,000	3,691,176	1,976,630	4,007,921	2,086,902
Houston	178	427,116			113	831,466	423,983				1,258,582	769,947		
Berkeley	66	273,196	10	31,642	26	273,541	121,586	9	46,810	19,365	546,737	337,412	78,452	44,363
Spokane	277	720,410	74	174,556	99	699,780	299,717	45	326,979	138,440	1,420,190	811,207	501,535	262,375
Total	4,962	12,950,440	1,917	5,421,335	1,675	13,695,465	6,772,352	1,071	8,311,084	4,169,168	26,645,905	14,797,358	13,732,419	7,398,169

[1] Includes amount of prior liens.

FEDERAL FARM MORTGAGE CORPORATION

TABLE 60.—*Real estate, sheriffs' certificates, etc., held Dec. 31, 1939, by States*

District and State	Farms [1]	Sheriffs' certificates, etc.	Total
District 1:			
Maine	54		54
New Hampshire	2		2
Vermont	3		3
Massachusetts	39		39
Rhode Island	1		1
Connecticut	4		4
New York	28		28
New Jersey	18		18
Total	149		149
District 2:			
Pennsylvania	69		69
Delaware	9		9
Maryland	42		42
Virginia	73		73
West Virginia	20		20
Puerto Rico			
Total	213		213
District 3:			
North Carolina	29		29
South Carolina	28		28
Georgia	47		47
Florida	36		36
Total	140		140
District 4:			
Ohio	33		33
Indiana	22		22
Kentucky	32	3	35
Tennessee	32		32
Total	119	3	122
District 5:			
Alabama	9	95	104
Mississippi	137		137
Louisiana	10		10
Total	156	95	251
ict 6:			
llinois	30	48	78
Missouri	76	1	77
Arkansas	19	3	22
Total	125	52	177
District 7:			
Michigan	169	220	389
Wisconsin	420		420
Minnesota	553	500	1,053
North Dakota	937	607	1,544
Total	2,079	1,327	3,406
District 8:			
Iowa	167	163	330
South Dakota	1,232	431	1,663
Nebraska	475		475
Wyoming	37	21	58
Total	1,911	615	2,526
District 9:			
Kansas	437	709	1,146
Oklahoma	132		132
Colorado	407	38	445
New Mexico	10	11	21
Total	986	758	1,744
District 10: Texas	291		291
District 11:			
Arizona	2		2
Utah	23	18	41
Nevada	2		2
California	65	1	66
Total	92	19	111
District 12:			
Montana	212	22	234
Idaho	68	25	93
Washington	51	34	85
Oregon	45	38	83
Total	376	119	495
Grand total	6,637	2,988	9,625

[1] Includes farms held subject to prior liens.

FEDERAL FARM MORTGAGE CORPORATION

TABLE 61.—*Federal Farm Mortgage Corporation bonds issued and retired from organization to Dec. 31, 1939, and outstanding Dec. 31, 1939*

Date of issue	Term (years)	Rate (percent)	Maturity	Amount issued	Amount retired	Amount outstanding, Dec. 31, 1939
Mar. 1, 1934	1	2	Mar. 1, 1935	$76,900,000	$76,900,000	
Mar. 15, 1934	10–30	3¼	Mar. 15, 1964	106,231,200	11,552,600	$94,678,600
May 15, 1934	10–15	3	May 15, 1949	983,659,800	148,574,200	835,085,600
Jan. 15, 1935	7–12	3	Jan. 15, 1947	237,565,400	1,089,200	236,476,200
Feb. 15, 1935	2½	1¼	Aug. 15, 1937	22,325,000	22,325,000	
Mar. 1, 1935	7–12	2¾	Mar. 1, 1947	104,755,600	1,608,100	103,147,500
Sept. 3, 1935	4	1½	Sept. 3, 1939	100,122,000	100,122,000	
Aug. 16, 1937	(1)	⅝	Feb. 16, 1938	10,000,000	10,000,000	
Nov. 1, 1937	2	1¼	Nov. 1, 1939	10,000,000	10,000,000	
Sept. 1, 1939	(1)	½	Mar. 1, 1940	15,000,000	15,000,000	
Sept. 1, 1939	1	¾	Sept. 1, 1940	10,000,000		10,000,000
Total				1,676,559,000	397,171,100	1,279,387,900

[1] 6 months.

TABLE 62.—*Statement of condition, Dec. 31, 1939*

ASSETS

Mortgage loans:			
Unpaid principal:			
First mortgage loans	$251,764,126.15		
Second mortgage loans	439,115,684.93	$690,879,811.08	
Matured principal unpaid:			
First mortgage loans	5,640,249.72		
Second mortgage loans	12,117,412.68	17,757,662.40	$673,122,148.68
Purchase money mortgages and contracts:			
Purchase money first mortgages	2,223,883.29		
Purchase money second mortgages	746,647.28		
Real estate sales contracts	6,509,141.48	9,479,672.05	
Less matured principal unpaid		178,184.75	9,301,487.30
Unmatured extensions		1,414,051.53	
Less reserve		1,414,051.53	
Delinquent installments, advances, etc.:			
Mortgage loans	36,161,006.28		
Purchase money mortgages and contracts	222,005.52	36,383,011.80	
Less reserve		18,447,164.65	17,935,847.15
Cash—General funds:			
Deposited—With the Treasurer of the United States		18,894,187.22	
Undeposited receipts—With district disbursing officers		41,846.74	18,936,033.96
Deposits with the Treasurer of the United States for matured bond interest and principal			1,647,409.06
Due from the Secretary of the Treasury—Interest reduction			2,026,142.10
Accounts receivable			954,798.23
Consolidated Federal farm loan bonds (par)			761,129,840.00
Consolidated Federal intermediate credit bank debentures (par $200,000)			200,156.64
Accrued interest receivable (not due):			
Mortgage loans		9,932,871.04	
Consolidated Federal farm loan bonds		6,828,820.16	
Consolidated Federal intermediate credit bank debentures		1,547.23	16,763,238.43

FEDERAL FARM MORTGAGE CORPORATION

TABLE 62.—*Statement of condition, Dec. 31, 1939*—Continued

ASSETS—Continued

Real estate owned:			
Not subject to prior liens (investment)		$12,950,440.22	
Subject to prior liens (investment)	$13,695,465.36		
Less unmatured prior liens not assumed	6,772,352.28	6,923,113.08	
Total		19,873,553.30	
Less reserve		11,848,547.95	$8,025,005.35
Sheriffs' certificates, etc.:			
Not subject to prior liens (investment)		5,421,334.70	
Subject to prior liens (investment)	8,311,083.92		
Less unmatured prior liens not assumed	4,169,167.60	4,141,916.32	
Total		9,563,251.02	
Less reserve		6,334,249.21	3,229,001.81
Loans called for foreclosure, judgments, etc. (investment)		8,497,318.60	
Less reserve		5,814,775.51	2,682,543.09
Loans in suspense—Prior liens in foreclosure (investment)		5,990,407.28	
Less reserve		5,990,407.28	
Chattels owned (investment)		9,141.27	
Less reserve		9,141.27	
Unamortized discount on bonds sold			285,063.48
Other assets			138,193.53
Total assets			1,516,376,908.81

LIABILITIES

Federal Farm Mortgage Corporation bonds:			
Outstanding		$1,279,387,900.00	
Less on hand			$1,279,387,900.00
Matured obligations:			
Federal Farm Mortgage Corporation bonds matured		430,000.00	
Matured interest on Federal Farm Mortgage Corporation bonds		1,217,409.06	1,647,409.06
Accrued interest on Federal Farm Mortgage Corporation bonds (not due)			8,348,955.92
Deferred proceeds of loans			431,080.25
Accounts payable			894,205.32
Matured items on prior liens not assumed			1,144,722.28
Trust accounts			750,388.82
Payments received on unmatured items:			
Installments:			
Mortgage loans		806,946.00	
Purchase money mortgages and contracts		13,479.07	
Unmatured extensions		14,173.25	834,598.32
Other liabilities			846,733.39
Unamortized premium on bonds sold			776,702.58
Reserve for title losses			278,582.65
Capital stock			200,000,000.00
Reserve for losses on mortgage loans			21,035,630.22
Total liabilities			1,516,376,908.81

FEDERAL FARM MORTGAGE CORPORATION

TABLE 63.—*Profit and loss statement for the years ended Dec. 31, 1939, and Dec. 31, 1938*

EARNINGS	Jan. 1 to Dec. 31, 1939		Jan. 1 to Dec. 31, 1938	
Interest:				
Mortgage loans	$35,506,794.62		$38,948,057.67	
Consolidated Federal farm loan bonds	29,385,580.35		29,385,580.35	
Notes receivable and Federal intermediate credit bank debentures	260,004.88		770,836.12	
Purchase money mortgages, contracts, and other	1,441,376.88	$66,593,756.73	453,890.15	$69,558,364.29
Other income:				
Loan fees	519,430.90		511,859.92	
Miscellaneous	199,522.46	718,953.36	70,098.13	581,958.05
Gross earnings		67,312,710.09		70,140,322.34
DEDUCTIONS FROM EARNINGS				
Interest on bonds	39,238,329.25		40,475,772.86	
Other interest expense	26,068.45		18,618.20	
Operating expense	9,968,897.21		8,938,431.44	
Total deductions from gross earnings		49,233,294.91		49,432,822.50
Net operating earnings		18,079,415.18		20,707,499.84
OTHER EARNINGS				
Premium on bonds sold (amortized)		276,062.88		198,630.22
OTHER DEDUCTIONS				
Mortgage loan and real estate transactions:				
Net loss on real estate and chattels	8,831,808.20		3,869,768.28	
Mortgage loans charged off	7,907,213.93		4,268,521.23	
Purchase money mortgages charged off	805.00		597.19	
Accounts and notes receivable charged off	354.33	16,740,181.46	15,421.26	8,154,307.96
Discount on bonds sold and premium on securities purchased (amortized)	363,348.14		1,612,037.25	
Premium on bonds reacquired	505,062.50	868,410.64		1,612,037.25
Total other deductions		17,608,592.10		9,766,345.21
Net profit before adjustment of reserves		746,885.96		11,139,784.85
Adjustment of reserves (net)		7,469,519.73		16,339,095.16
Net profit after adjustment of reserves transferred to reserve for losses on mortgage loans [1]		−6,722,633.77		−5,199,310.31

[1] The Board of Directors of the Federal Farm Mortgage Corporation has determined that the entire net earnings of the Corporation after adjustment of reserves shall be appropriated to a "Reserve for losses on mortgage loans" until the balance in the reserve account equals 10 percent of the unpaid balance of second mortgage loans and 2½ percent of the unpaid balance of first mortgage loans. During the period from the date of organization through Dec. 31, 1939, net earnings of the Corporation amounted to $21,035,630.22, all of which has been transferred to this reserve. On the basis of loans outstanding as of Dec. 31, 1939, the total reserve to be created, as earnings permit, would amount to approximately $50,205,671.65.

EMERGENCY CROP AND FEED LOANS

TABLE 64.—*Loans made, 1918–37, 1938, and 1939, and balances outstanding, Dec. 31, 1939, by States*

District and State	Loans made						Balances outstanding, Dec. 31, 1939					
	1918–37		1938		1939		Amount			Percent of loans made		
	Number	Amount	Number	Amount	Number	Amount	1918–37 loans	1938 loans	1939 loans	1918–37 loans	1938 loans	1939 loans
District 1:												
Maine	7,468	$1,892,505	706	$188,715	683	$198,775	$416,652	$33,826	$121,886	22.0	17.9	61.3
New Hampshire	715	76,750	134	12,955	80	9,910	16,383	2,969	4,305	21.3	22.9	43.4
Vermont	1,062	99,938	219	25,605	231	27,435	21,369	3,944	13,040	21.4	15.4	47.5
Massachusetts	671	117,458	111	22,850	96	21,790	25,367	6,849	8,879	21.6	30.0	40.7
Rhode Island	1	160					160			100.0		
Connecticut	441	86,860	86	20,045	77	18,325	9,052	4,279	9,092	10.4	21.3	49.6
New York	4,685	698,480	692	117,270	738	127,775	108,679	15,337	43,179	15.6	13.1	33.8
New Jersey	1,342	241,843	140	32,255	145	34,625	32,714	6,395	7,170	13.5	19.8	20.7
Total	16,385	3,213,994	2,088	419,695	2,050	438,635	630,376	73,599	207,551	19.6	17.5	47.3
District 2:												
Pennsylvania	10,226	1,230,514	1,559	229,220	1,210	169,965	348,063	62,963	91,210	28.3	27.5	53.7
Delaware	1,014	130,772	130	13,890	139	12,950	45,128	5,017	8,611	34.5	36.1	66.5
Maryland	5,734	704,452	748	104,545	584	75,380	248,702	36,776	47,324	35.3	35.2	62.8
Virginia	89,835	7,841,819	8,468	718,800	8,034	742,395	1,623,312	70,171	202,608	20.7	9.8	27.3
West Virginia	11,763	900,396	522	29,150	493	27,005	368,834	5,696	11,773	41.0	19.5	43.6
Puerto Rico	8,189	1,609,668	2,470	439,650	2,793	419,250	99,862	17,670	401,032	6.2	4.0	95.7
Total	126,761	12,417,621	13,897	1,535,255	13,253	1,446,945	2,733,901	198,293	762,558	22.0	12.9	52.7
District 3:												
North Carolina	215,647	20,122,456	14,299	1,176,210	12,994	1,135,975	1,323,642	66,203	158,932	6.6	5.6	14.0
South Carolina	221,819	23,113,816	16,260	1,683,600	13,571	1,420,890	1,904,996	112,475	66,653	8.2	6.7	4.7
Georgia	258,823	25,684,570	16,278	1,614,295	13,158	1,336,745	2,110,535	122,951	143,974	8.2	7.6	10.8
Florida	26,511	2,960,303	1,173	155,175	1,251	179,225	1,191,453	32,016	154,809	40.2	20.6	86.4
Total	722,800	71,881,145	48,010	4,629,280	40,974	4,072,835	6,530,626	333,645	524,368	9.1	7.2	12.9

EMERGENCY CROP AND FEED LOANS

TABLE 64.—*Loans made, 1918–37, 1938, and 1939, and balances outstanding, Dec. 31, 1939, by States*—Continued

District and State	Loans made						Balances outstanding, Dec. 31, 1939					
	1918–37		1938		1939		Amount			Percent of loans made		
	Number	Amount	Number	Amount	Number	Amount	1918–37 loans	1938 loans	1939 loans	1918–37 loans	1938 loans	1939 loans
District 4:												
Ohio	15,832	$1,634,173	918	$79,610	811	$73,065	$303,604	$4,756	$35,293	18.6	6.0	48.3
Indiana	15,670	1,712,209	390	37,905	378	35,715	358,807	3,545	17,468	21.0	9.4	48.9
Kentucky	79,145	4,965,204	3,206	167,175	3,336	180,410	1,062,950	11,981	108,585	21.4	7.2	60.2
Tennessee	107,285	7,627,153	5,950	341,400	5,183	309,570	878,687	5,741	82,550	11.5	1.7	26.7
Total	217,932	15,938,739	10,464	626,090	9,708	598,760	2,604,048	26,023	243,896	16.3	4.2	40.7
District 5:												
Alabama	124,347	10,809,207	4,127	281,715	3,575	233,380	1,542,200	15,898	69,652	14.3	5.6	29.8
Mississippi	197,050	16,217,051	9,578	520,100	9,106	536,105	1,398,047	28,504	147,543	8.6	5.5	27.5
Louisiana	153,317	12,177,672	10,147	657,670	9,137	647,130	886,705	33,413	46,553	7.3	5.1	7.2
Total	474,714	39,203,930	23,852	1,459,485	21,818	1,416,615	3,826,952	77,815	263,748	9.8	5.3	18.6
District 6:												
Illinois	11,511	1,232,193	510	60,530	458	57,165	202,939	3,555	16,638	16.5	5.9	29.1
Missouri	56,880	5,692,722	1,859	177,610	940	85,090	1,380,627	9,468	30,082	24.3	5.3	35.4
Arkansas	270,951	22,673,969	10,362	829,970	9,241	776,365	2,678,134	36,120	82,643	11.8	4.4	10.6
Total	339,342	29,598,884	12,731	1,068,110	10,639	918,620	4,261,700	49,143	129,363	14.4	4.6	14.1
District 7:												
Michigan	26,937	2,312,982	718	69,025	406	40,170	587,362	13,721	14,713	25.4	19.9	36.6
Wisconsin	35,050	2,439,110	275	24,985	70	6,485	960,337	3,655	1,094	39.4	14.6	16.9
Minnesota	53,117	6,089,941	1,481	153,595	1,099	119,325	2,590,100	18,269	18,290	42.5	11.9	15.3
North Dakota	202,710	38,944,802	13,740	2,332,655	7,507	994,505	29,741,094	1,462,686	283,998	76.4	62.7	28.6
Total	317,814	49,786,835	16,214	2,580,260	9,082	1,160,485	33,878,893	1,498,331	318,095	68.0	58.1	27.4

District 8:												
Iowa	7,819	1,056,633	269	33,295	144	19,150	127,365	752	8,216	12.1	2.3	42.9
South Dakota	115,693	23,626,055	5,504	877,200	2,819	397,100	15,238,628	534,171	226,281	64.5	60.9	57.0
Nebraska	39,118	6,125,583	4,254	552,995	1,640	176,165	2,499,464	133,796	120,058	40.8	24.2	68.2
Wyoming	10,695	1,784,874	696	127,255	445	88,814	733,226	31,865	41,619	41.1	25.0	46.9
Total	173,325	32,593,145	10,723	1,590,745	5,048	681,229	18,598,693	700,584	396,174	57.1	44.0	58.2
District 9:												
Kansas	68,587	11,850,022	2,531	339,710	2,710	363,040	6,452,838	142,246	352,705	54.5	41.9	97.4
Oklahoma	69,771	6,414,611	1,203	112,300	1,053	90,135	2,075,468	14,914	66,524	32.4	13.3	73.8
Colorado	32,744	4,996,144	979	142,955	640	96,545	2,531,482	31,267	63,643	50.7	21.9	65.9
New Mexico	29,725	4,166,135	943	158,665	930	148,505	1,855,052	49,935	79,865	44.5	31.5	53.8
Total	200,827	27,426,912	5,656	753,630	5,333	698,225	12,914,840	238,362	563,737	47.1	31.6	80.7
District 10: Texas	278,418	29,547,963	19,106	2,511,720	16,960	2,182,710	6,684,682	265,355	959,222	22.6	10.6	43.9
District 11:												
Arizona	2,602	467,105	295	61,860	339	81,090	89,240	18,393	57,252	19.1	29.7	70.6
Utah	12,072	1,274,899	857	108,995	786	108,790	183,653	24,618	62,209	14.4	22.6	57.2
Nevada	445	67,241	15	2,350	14	2,320	5,643	454	680	8.4	19.3	29.3
California	4,394	817,331	1,474	339,715	1,712	412,225	98,359	80,162	196,112	12.0	23.6	47.6
Hawaii	170	39,227	35	11,535	42	15,290	1,277	767	13,689	3.3	6.6	89.5
Total	19,683	2,665,803	2,676	524,455	2,893	619,715	378,172	124,394	329,942	14.2	23.7	53.2
District 12:												
Montana	89,164	16,497,696	6,758	1,411,270	2,779	453,865	11,119,946	771,912	79,189	67.4	54.7	17.4
Idaho	16,557	2,541,330	644	109,525	484	87,380	291,953	20,363	36,603	11.5	18.6	41.9
Washington	11,469	2,657,999	1,269	353,845	1,175	340,855	631,802	36,532	98,246	23.8	10.3	28.8
Oregon	7,652	1,044,324	469	74,170	447	74,260	238,481	14,081	40,754	22.8	19.0	54.9
Total	124,842	22,741,349	9,140	1,948,810	4,885	956,360	12,282,182	842,888	254,792	54.0	43.2	26.6
Total, all districts	3,012,843	337,016,320	174,557	19,647,535	142,643	15,191,134	105,325,065	4,428,432	4,953,446	31.3	22.5	32.6
1918–19 loans and adjustments	15,973	4,044,662					1,068,186			26.4		
Grand total	3,028,816	341,060,982	174,557	19,647,535	142,643	15,191,134	106,393,251	4,428,432	4,953,446	31.2	22.5	32.6

DROUGHT RELIEF LOANS

TABLE 65.—*Loans made during 1934 and 1935 and balances outstanding Dec. 31, 1939, by States*

District and State	Loans made 1934–35		Balance outstanding, Dec. 31, 1939	
	Number	Amount	Amount	Percent of loans made
District 1: New York	399	$48,823	$6,636	13.6
District 2: Pennsylvania			[1] 63	48.6
District 3: Florida	964	397,701	110,691	27.8
District 4: Indiana			[1] 26	50.0
District 5:				
Alabama			[1] 75	100.0
Louisiana	7,363	452,553	362,074	80.0
Total	7,363	452,553	362,149	80.0
District 6:				
Illinois	1,450	125,359	26,390	21.1
Missouri	20,610	2,031,368	1,003,857	49.4
Arkansas	13,408	683,402	422,192	61.8
Total	35,468	2,840,129	1,452,439	51.1
District 7:				
Michigan			799	47.7
Wisconsin	5,777	1,024,851	[1] 745,094	72.7
Minnesota	27,133	6,683,957	5,573,751	83.4
North Dakota	44,404	12,119,681	11,500,022	94.9
Total	77,314	19,828,489	17,819,666	89.9
District 8:				
Iowa	7,154	1,012,389	413,945	40.9
South Dakota	43,989	16,263,348	13,745,375	84.5
Nebraska	24,916	7,257,093	5,210,698	71.8
Wyoming	3,305	2,830,567	1,512,890	53.4
Total	79,364	27,363,397	20,882,908	76.3
District 9:				
Kansas	16,412	3,382,690	2,331,699	68.9
Oklahoma	12,518	1,150,297	542,058	47.1
Colorado	7,408	2,333,062	1,353,154	58.0
New Mexico	5,482	1,813,062	756,621	41.7
Total	41,820	8,679,111	4,983,532	57.4
District 10: Texas	42,834	6,970,224	3,590,758	51.5
District 11:				
Arizona	278	60,398	25,735	42.6
Utah	4,007	1,752,497	1,178,670	67.3
Nevada	102	119,618	45,303	37.9
California	1,251	241,049	61,760	25.6
Total	5,638	2,173,562	1,311,468	60.3
District 12:				
Montana	6,396	1,672,064	1,236,119	73.9
Idaho	1,678	1,051,717	599,143	57.0
Washington	1,175	387,954	143,531	37.0
Oregon	201	142,816	55,976	39.2
Total	9,450	3,254,551	2,034,769	62.5
Grand total	300,614	72,008,540	52,555,105	73.0

[1] Transferred from drought areas.

EMERGENCY CROP AND FEED LOAN OFFICES

TABLE 66.—*Statement of condition of 1918–19 wheat loans, 1921–31 farmers' seed loans, and loans for the purchase of capital stock of agricultural credit corporations, Dec. 31, 1939*

ASSETS			
Loans:			
Made 1918–19, wheat	$4,200,882.70		
Less repayments	3,148,433.33		
Total	1,052,449.37		
Less reserve	1,052,449.37		
Made 1921–31, farmer's seed and feed	70,835,685.66		
Less repayments	52,326,828.55		
Total	18,508,857.11		
Less reserve	18,000,000.00	$508,857.11	
Made for purchase of capital stock of agricultural credit corporations	1,513,023.94		
Less repayments	1,073,911.48	439,112.46	$947,969.57
Cash:			
In appropriations with Treasurer of the United States		310,395.47	
On deposit with the Treasurer of the United States		3,680.65	314,076.12
Total assets			1,262,045.69
LIABILITIES			
Unapplied receipts			$445.50
Capital:			
Transferred from Secretary of Treasury, May 27, 1933: 1918–19 wheat loans outstanding		$1,052,449.37	
Transferred from Secretary of Agriculture, May 27, 1933:			
1921–31 loans outstanding	$43,176,028.41		
Unexpended balances in appropriations	16,606,580.86	59,782,609.27	
Total		60,835,058.64	
Less:			
Reserve for losses on 1918–19 wheat loans	1,052,449.37		
Reserve for estimated losses on 1921–31 farmers' seed and feed loans	18,000,000.00		
Transferred to Farm Credit Administration revolving fund	35,000,000.00		
Transferred to Treasury surplus	4,426,222.63		
Transferred to Federal Credit Union	50,000.00		
Transferred to Department of Agriculture master appropriation account	3,220.79		
Cotton collateral adjustments	584,586.08		
Losses on compromised settlements	21,078.86		
Administrative expenses	435,900.72	59,573,458.45	1,261,600.19
Total liabilities			1,262,045.69

EMERGENCY CROP AND FEED LOAN OFFICES

TABLE 67.—*Statement of condition of 1932 and 1933 emergency crop and feed loans, Dec. 31, 1939*

ASSETS			
Loans:			
Made in 1932	$64,204,503.06		
Less repayments	41,864,333.80	$22,340,169.26	
Made in 1933	57,375,939.87		
Less repayments	47,800,391.44	9,575,548.43	
Total		31,915,717.69	
Less reserve		28,000,000.00	$3,915,717.69
Cash:			
In appropriation with the Treasurer of the United States		526,224.17	
On deposit with the Treasurer of the United States		130,121.46	656,345.63
Total assets			4,572,063.32
LIABILITIES			
Accounts payable			$3,980.35
Unapplied receipts			1,244.17
Capital:			
Funds allocated from Reconstruction Finance Corporation		$200,000,000.00	
Interest revenue:			
1932 loans	$3,515,585.60		
1933 loans	2,110,504.74	5,626,090.34	
Total		205,626,090.34	
Less:			
Transferred to Farm Credit Administration revolving fund	45,000,000.00		
Transferred to Federal intermediate credit bank revolving fund	40,000,000.00		
Allotted for capital stock of regional agricultural credit corporations	44,500,000.00		
Transferred to Treasury surplus	30,468,387.04		
Reserve for estimated losses on loans	28,000,000.00		
Cotton collateral adjustments	451,074.64		
Loss on compromise settlements	3,765.98		
Administrative expenses	12,636,023.88	201,059,251.54	4,566,838.80
Total liabilities			4,572,063.32

EMERGENCY CROP AND FEED LOAN OFFICES

TABLE 68.—*Statement of condition of 1934 emergency crop and feed loans, Dec. 31, 1939*

ASSETS			
Loans:			
Made in 1934	$37,891,586.00		
Less repayments	23,966,017.24	$13,925,568.76	
Less reserve		12,000,000.00	$1,925,568.76
Cash:			
In appropriation with the Treasurer of the United States		143,005.38	
On deposit with the Treasurer of the United States		6,135.07	149,140.45
Total assets			2,074,709.21
LIABILITIES			
Accounts payable			$819.42
Unapplied receipts			1,687.95
Capital:			
Funds appropriated under act of Feb. 23, 1934	$40,000,000.00		
Interest revenue	1,448,028.64	$41,448,028.64	
Less:			
Transferred to Treasury surplus	21,521,667.38		
Reserve for estimated losses on loans	12,000,000.00		
Transferred to Farm Credit Administration for administrative expenses	2,375,000.00		
Loss on compromise settlements	1,187.25		
Administrative expenses	3,477,972.17	39,375,826.80	2,072,201.84
Total liabilities			2,074,709.21

TABLE 69.—*Statement of condition of 1935 emergency crop and feed loans, Dec. 31, 1939*

ASSETS			
Loans:			
Made in 1935	$57,419,914.64		
Less repayments	31,182,674.89	$26,237,239.75	
Less reserve		20,000,000.00	$6,237,239.75
Cash:			
In appropriation with the Treasurer of the United States		157,250.72	
On deposit with the Treasurer of the United States		13,702.19	170,952.91
Total assets			6,408,192.66
LIABILITIES			
Accounts payable			$3,325.97
Capital:			
Funds appropriated under act of Feb. 20, 1935		$60,000,000.00	
Interest revenue		1,693,057.28	
		61,693,057.28	
Less:			
Transferred to Treasury surplus	$28,100,739.72		
Reserve for estimated losses on loans	20,000,000.00		
Transferred to Farm Credit Administration for administrative expenses	4,400,000.00		
Loss on compromise settlements	725.80		
Administrative expenses	2,786,725.07	55,288,190.59	6,404,866.69
Total liabilities			6,408,192.66

EMERGENCY CROP AND FEED LOAN OFFICES

TABLE 70.—*Statement of condition of 1936 emergency crop and feed loans, Dec. 31, 1939*

ASSETS			
Loans:			
Made in 1936	$16,629,189.82		
Less repayments	12,981,804.70	$3,647,385.12	
Less reserve		2,000,000.00	$1,647,385.12
Cash:			
In appropriation with the Treasurer of the United States		845.56	
On deposit with the Treasurer of the United States		2,437.48	3,283.04
Total assets			1,650,668.16
LIABILITIES			
Accounts payable			$317.84
Unapplied receipts			510.40
Capital:			
Funds allotted under Executive order of Feb. 28, 1936	$37,000,000.00		
Interest revenue	542,418.37	$37,542,418.37	
Less:			
Portion of allotment rescinded	20,116,192.52		
Reserve for estimated losses on loans	2,000,000.00		
Collections transferred to miscellaneous receipts	12,991,986.27		
Administrative expenses	784,399.66	35,892,578.45	1,649,839.92
Total liabilities			1,650,668.16

TABLE 71.—*Statement of condition of 1937, 1938, 1939, and 1940 emergency crop and feed loans, Dec. 31, 1939*

ASSETS			
Loans:			
Made in 1937	$32,503,280.41		
Less repayments	21,397,247.11	$11,106,033.30	
Made in 1938	19,647,535.00		
Less repayments	15,219,103.31	4,428,431.69	
Made in 1939	14,997,049.00		
Less repayments	10,237,688.11	4,759,360.89	
Made in 1939 (1940 loans)[1]	194,085.00		
Less repayments		194,085.00	
Total		20,487,910.88	
Less reserve		14,000,000.00	$6,487,910.88
Cash:			
In appropriation with the Treasurer of the United States		27,805,721.71	
On deposit with the Treasurer of the United States		8,836,284.84	36,642,006.55
Total assets			43,129,917.43

EMERGENCY CROP AND FEED LOAN OFFICES

TABLE 71.—*Statement of condition of 1937, 1938, 1939, and 1940 emergency crop and feed loans, Dec. 31, 1939—Continued*

LIABILITIES

Accounts payable			$4,544.62
Unapplied receipts			136,083.58
Capital:			
Funds appropriated under acts of Jan. 29, 1937, and Feb. 4, 1938		$50,000,000.00	
Funds appropriated under act of June 30, 1939		15,000,000.00	
Interest revenue:			
1937 loans	$759,709.33		
1938 loans	449,557.44		
1939 loans	327,966.83		
1940 loans	6,509.92	1,543,743.52	
Total		66,543,743.52	
Less:			
Reserve for estimated losses on loans	14,000,000.00		
Funds transferred to Farm Credit Administration for administrative expenses	6,750,000.00		
Administrative expenses	2,804,454.29	23,554,454.29	42,989,289.23
Total liabilities			43,129,917.43

[1] Made in November and December 1939 on 1940 crops.

TABLE 72.—*Statement of condition of 1934–35 drought relief loans, Dec. 31, 1939*

ASSETS

Loans:			
Made in 1934–35	$72,008,539.50		
Less repayments	19,453,434.56	$52,555,104.94	
Less reserve		20,000,000.00	$32,555,104.94
Cash:			
In appropriation with the Treasurer of the United States		1,201,155.46	
On deposit with the Treasurer of the United States		119,403.79	1,320,559.25
Total assets			33,875,664.19

LIABILITIES

Accounts payable			$1,078.62
Capital:			
Funds appropriated under act of June 19, 1934	$96,785,000.00		
Interest revenue	1,278,365.73	$98,063,365.73	
Less:			
Funds transferred to Treasury surplus	30,258,615.22		
Funds transferred to Treasury reserve	10,000,000.00		
Reserve for estimated losses on loans	20,000,000.00		
Transferred to Farm Credit Administration for administrative expenses	1,100,000.00		
Collections of interest transferred to miscellaneous receipts	1,262,313.23		
Loss on compromise settlements	15,275.57		
Administrative expenses	1,552,576.14	64,188,780.16	33,874,585.57
Total liabilities			33,875,664.19

REGIONAL AGRICULTURAL CREDIT CORPORATIONS

TABLE 73.—*Number and amount of loans outstanding, Apr. 30, 1934, percent reduction in amount from May 1, 1934, to Dec. 31, 1939, and number and amount of loans outstanding, Dec. 31, 1939, by States*

District and State	Loans outstanding, Apr. 30, 1934		Percent reduction in amount from May 1, 1934, to Dec. 31, 1939	Loans outstanding, Dec. 31, 1939	
	Number	Amount		Number	Amount
District 1:					
Maine	182	$43,971	99.9	2	$11
New Hampshire	59	25,177	100.0		
Vermont	194	133,729	100.0		
Massachusetts	250	173,706	98.5	5	2,677
Rhode Island	21	10,314	100.0		
Connecticut	51	52,043	99.5	1	242
New York	878	639,073	97.8	8	13,867
New Jersey	295	574,713	75.5	11	140,684
Total	1,930	1,652,726	90.5	27	157,481
District 2:					
Pennsylvania	89	51,150	99.9	2	75
Delaware	14	9,735	100.0		
Maryland	81	89,331	99.5	1	417
Virginia	93	184,551	99.0	2	1,881
West Virginia	85	141,826	95.4	1	6,514
Puerto Rico	5	21,146	100.0		
Total	367	497,739	98.2	6	8,887
District 3:					
North Carolina	67	47,949	98.8	2	573
South Carolina	29	40,060	100.0		
Georgia	243	483,816	98.4	4	7,839
Florida	641	569,830	95.8	49	24,177
Total	980	1,141,655	97.1	55	32,589
District 4:					
Ohio	1,050	370,425	99.8	2	853
Indiana	908	311,414	99.9	1	14
Kentucky	1,086	367,996	99.9	10	380
Tennessee	1,312	460,141	99.9	5	393
Total [1]	4,356	1,509,976	99.9	18	1,640
District 5:					
Alabama	559	367,758	99.9	4	498
Mississippi	539	253,319	99.6	13	1,002
Louisiana	746	512,731	99.7	6	1,390
Total	1,844	1,133,808	99.7	23	2,890
District 6:					
Illinois	56	48,557	100.0		
Missouri	217	149,274	99.9	1	72
Arkansas	480	161,994	97.5	29	4,118
Total [1]	753	359,825	98.8	30	4,190

REGIONAL AGRICULTURAL CREDIT CORPORATIONS

TABLE 73.—*Number and amount of loans outstanding, Apr. 30, 1934, percent reduction in amount from May 1, 1934, to Dec. 31, 1939, and number and amount of loans outstanding, Dec. 31, 1939, by States*—Continued

District and State	Loans outstanding, Apr. 30, 1934		Percent reduction in amount from May 1, 1934, to Dec. 31, 1939	Loans outstanding, Dec. 31, 1939	
	Number	Amount		Number	Amount
District 7:					
Michigan	1,216	$567,145	98.1	43	$10,565
Wisconsin	7,721	4,139,641	99.0	120	41,833
Minnesota	17,542	11,454,275	97.7	515	262,042
North Dakota	17,688	15,893,636	73.7	6,209	4,186,128
Total [1]	44,167	32,054,697	86.0	6,887	4,500,568
District 8:					
Iowa	3,988	2,572,547	99.8	18	4,791
South Dakota	11,816	9,425,661	95.7	680	409,302
Nebraska	11,789	11,281,844	99.3	166	80,980
Wyoming	1,891	8,614,593	99.2	18	72,371
Total [1]	29,484	31,894,645	98.2	882	567,444
District 9:					
Kansas	4,937	4,930,107	98.8	28	57,073
Oklahoma	2,314	2,907,462	99.9	5	2,195
Colorado	4,340	8,414,153	96.0	46	335,864
New Mexico	1,011	5,255,921	97.1	11	154,428
Total [1]	12,602	21,507,643	97.4	90	549,560
District 10: Texas [1]	8,290	12,789,052	97.6	100	309,716
District 11:					
Arizona	192	811,906	100.0		
Utah	1,203	3,720,585	98.1	10	70,615
Nevada	336	2,867,257	82.2	7	509,343
California	1,410	3,537,598	99.8	3	8,662
Total [1]	3,141	10,937,346	94.6	20	588,620
District 12:					
Montana	5,929	13,614,676	96.7	131	454,592
Idaho	2,363	8,682,120	90.7	19	805,224
Washington	1,540	2,483,724	99.8	7	3,786
Oregon	1,262	4,411,542	99.6	3	17,561
Total [1]	11,094	29,192,062	95.6	160	1,281,163
Grand total	119,008	144,671,174	94.5	8,298	8,004,748

[1] Totals by States in this district do not agree with figures for the corresponding corporations because some business crossed district lines in accordance with customary marketing areas.

REGIONAL AGRICULTURAL CREDIT CORPORATIONS

TABLE 74.—*Number and amount of loans outstanding, Apr. 30, 1934, percent reduction in amount from May 1, 1934, to Dec. 31, 1939, and number and amount of loans outstanding, Dec. 31, 1939, by corporations*

Corporation	Loans outstanding, Apr. 30, 1934		Percent reduction in amount from May 1, 1934, to Dec. 31, 1939	Loans outstanding, Dec. 31, 1939	
	Number	Amount		Number	Amount
Washington, D. C.[1]	18,444	$18,732,396	97.2	259	$517,393
Minneapolis	44,214	32,120,842	85.9	6,911	4,525,121
Sioux City	29,363	31,130,440	98.2	864	547,648
Wichita (at Denver)	12,675	21,827,809	97.5	89	548,912
Salt Lake City [2]	14,312	40,859,687	95.4	175	1,865,674
Total	119,008	144,671,174	94.5	8,298	8,004,748

[1] The Regional Agricultural Credit Corporation of Washington, D. C., was created Sept. 30, 1937, and acquired all assets and assumed all liabilities of the Albany, Baltimore, Raleigh, Columbus, Jackson, and St. Louis corporations. The Fort Worth corporation was merged with the Regional Agricultural Credit Corporation of Washington, D. C., Sept. 1, 1938.

[2] The Spokane corporation was merged with the Regional Agricultural Credit Corporation of Salt Lake City, June 15, 1939.

TABLE 75.—*Changes during 1939 in amount of loans outstanding, by corporations*

Corporation	Disbursements on loans [1]	Repayments [1]	Charge-offs	Transfers to personal and real property and judgment accounts	Net reduction in loans outstanding
Washington, D. C.[2]	$199,952	$361,128	$22,102	$3,024	$186,302
Minneapolis	16,603	1,372,595	124,087	30,102	1,510,181
Sioux City	247,839	642,560	34,018	70	428,809
Wichita (at Denver)	549,981	734,311	35,016	7,063	226,409
Salt Lake City [3]	1,290,417	1,930,107	81,014	4,144	724,848
Total	2,304,792	5,040,701	296,237	44,403	3,076,549

[1] Excludes renewals.

[2] The Regional Agricultural Credit Corporation of Washington, D. C., was created Sept. 30, 1937, and acquired all assets and assumed all liabilities of the Albany, Baltimore, Raleigh, Columbus, Jackson, and St. Louis corporations. The Fort Worth corporation was merged with the Regional Agricultural Credit Corporation of Washington, D. C., Sept. 1, 1938.

[3] The Spokane corporation was merged with the Regional Agricultural Credit Corporation of Salt Lake City, June 15, 1939.

REGIONAL AGRICULTURAL CREDIT CORPORATIONS

TABLE 76.—*Consolidated statement of condition, Dec. 31, 1939, and Apr. 30, 1934*

	Dec. 31, 1939		Apr. 30, 1934	
ASSETS				
Loans	$8,004,747.61		[1] $144,693,005.77	
Less reserve	2,549,862.98	$5,454,884.63		$144,693,005.77
Cash:				
On deposit with Treasurer of the United States:				
Finance account	13,395,781.48		2,393,639.25	
Expense account	41,262.73		207,886.72	
On hand and in transit	32,768.52	13,469,812.73	2,922.12	2,604,448.09
Accounts receivable		30,611.25		
Accrued interest receivable on loans	440,723.39		4,605,324.59	
Less reserve	258,218.20	182,505.19		4,605,324.59
Personal and real property	96,309.50		113,595.42	
Less reserve	22,151.16	74,158.34		113,595.42
Sheriffs' certificates, judgments, etc	121,839.23			
Less reserve	69,734.68	52,104.55		
Furniture, fixtures, and equipment (net)				198,709.88
Prepaid interest on rediscounts				1,064,103.31
Other assets		2,595.72		535,830.92
Total assets		19,266,672.41		153,815,017.98
LIABILITIES				
Rediscounts outstanding:				
Federal intermediate credit banks			$88,386,510.66	
Reconstruction Finance Corporation			14,092,391.93	$102,478,902.59
Reserved for payment of operating expense [2]		$68,496.45		415,851.49
Unapplied receipts		37,904.87		292,064.94
Other liabilities		2,096.25		59,281.69
Capital stock		5,000,000.00		44,500,000.00
Surplus paid in by Reconstruction Finance Corporation [3]	$16,166,909.95		7,129,220.08	
Less impairment	2,008,735.11	14,158,174.84	1,060,302.81	6,068,917.27
Total liabilities		19,266,672.41		153,815,017.98
Loans authorized but not yet disbursed	$850,287.83		$30,095,555.47	

[1] The difference of $21,831.94 between this figure and the amount of loans outstanding, Apr. 30, 1934, as shown in tables 73 and 74, represents checks issued and outstanding on loans being renewed.

[2] Accountable to the Reconstruction Finance Corporation for advances made to defray operating expense.

[3] This amount has been paid in cash to regional agricultural credit corporations by the Reconstruction Finance Corporation and is equal to the total operating expense of the regional agricultural credit corporations from their organization to the date of this statement. (Payment by the Reconstruction Finance Corporation of the operating expense of the regional agricultural credit corporations is required by sec. 201 (e) of the act of July 21, 1932.)

AGRICULTURAL MARKETING ACT REVOLVING FUND

TABLE 77.—*Commitments and loans outstanding Dec. 31, 1939, by commodities*

Commodities	Commitments outstanding	Loans outstanding			
		Operating capital	Facility	Stabilization corporation	Total
Beans			$50,245		$50,245
Cotton		$7,389,659			7,389,659
Dairy products	$1,210,000	1,963,754	799,987		2,763,741
Fruits and vegetables:					
Citrus fruits			850,187		850,187
Grapes and raisins		2,275,533	2,983,942		5,259,475
Other deciduous fruits		31,853	229,724		261,577
Potatoes		3,248			3,248
Other fruits and vegetables		309,803	31,153		340,956
Grain	275,000	1,831,098		$66,659,613	68,490,711
Livestock		1,646,807			1,646,807
Nuts			5,713		5,713
Poultry and eggs		71,631			71,631
Rice			67,937		67,937
Seeds			4,180		4,180
Wool and mohair			976		976
Total	1,485,000	15,523,386	5,024,044	66,659,613	87,207,043

AGRICULTURAL MARKETING ACT REVOLVING FUND

TABLE 78.—*Commitments, advances, cash repayments, and charge-offs and transfers to other asset accounts, by periods, from June 15, 1929, to Dec. 31, 1939, and loans and commitments outstanding at end of each period*

Period	Net commitments	Advances on commitments	Cash repayments	Refinanced by banks for cooperatives	Charge-offs and transfers to other asset accounts	Loans outstanding at end of period	Commitments outstanding at end of period
1929 (June 15–Dec. 31)	$60,755,000	$14,823,235	$313,349			$14,509,886	$45,931,765
1930	345,302,257	348,551,947	129,306,173			233,755,660	42,682,075
1931	494,701,254	516,821,426	314,323,467			436,253,619	20,561,903
1932	219,718,816	229,026,034	182,680,109		$16,098,078	466,501,466	11,254,685
1933 (Jan. 1–May 26)	37,464,014	39,683,890	34,735,285		5,207,403	466,242,668	9,034,809
Total	1,157,941,341	1,148,906,532	661,358,383		21,305,481		
1933 (May 27–Dec. 31)	166,712	7,027,141	22,562,073	$10,425,000	106,190,966	334,091,770	2,174,380
1934	10,038,375	9,554,823	15,215,765	1,327,815	180,192,374	146,910,639	2,657,932
1935	6,094,139	7,402,344	12,837,776	6,014,015	19,602,651	115,858,541	1,349,727
1936	27,057,284	20,449,466	14,469,824	28,516	47,804	121,761,863	7,957,545
1937	2,436	5,934,981	14,903,624		13,822,443	98,970,777	2,025,000
1938	8,640,500	7,910,500	15,658,167	2,400	37,706	91,183,004	2,755,000
1939	−56,200	1,213,800	4,065,412	1,124,000	349	87,207,043	1,485,000
Total	51,943,246	59,493,055	99,712,641	18,921,746	319,894,293		
Grand total	1,209,884,587	1,208,399,587	761,071,024	18,921,746	341,199,774		

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AGRICULTURAL MARKETING ACT REVOLVING FUND

TABLE 79.—*Statement of condition, Dec. 31, 1939*

ASSETS

Loans:			
Operating capital		$15,523,385.64	
Facility		5,024,044.51	
Stabilization corporations		66,659,612.61	
Total		87,207,042.76	
Less reserve		75,680,588.29	$11,526,454.47
Capital stock of banks:			
Central Bank for Cooperatives		50,000,000.00	
District banks for cooperatives		99,000,000.00	149,000,000.00
Cash on deposit with the Treasurer of the United States			14,839,381.39
Notes and accounts receivable		11,157.12	
Less reserve		161.56	10,995.56
Purchase money mortgages, contracts:			
Purchase money mortgages		205,378.59	
Real estate sales contracts		28,741.37	
Total		234,119.96	
Less reserve		92,244.09	141,875.87
Sheriffs' certificates and judgments		290,209.90	
Less reserve		245,700.75	44,509.15
Assets acquired in liquidation of loans		7,518,809.40	
Less reserve		2,620,698.68	4,898,110.72
Assets acquired under transactions authorized by the Agricultural Adjustment Act		18,763.62	
Less reserve		11,815.30	6,948.32
Notes and accounts reported to the Comptroller General of the United States for collection			[1] 2,743,694.04
Total assets			183,211,969.52

LIABILITIES

Unapplied cash receipts		$1,909.26	
Liability for miscellaneous trust funds		159,383.28	
Reserve for notes and accounts reported to the Comptroller General of the United States for collection		2,743,694.04	$2,904,986.58
Capital:			
Appropriated by Congress	$500,000,000.00		
Expenditures from Farm Credit Administration annual appropriation	1,751.49		
Interest collected	21,553,283.71	521,555,035.20	
Less:			
Loans canceled in connection with donations of wheat and cotton to the American National Red Cross, Public Res. Nos. 12 and 33 and Public Act No. 329, 72d Cong.	197,385,144.41		
Determined loss on cotton sold to Secretary of Agriculture in accordance with sec. 3 of Agricultural Adjustment Act	46,298,337.28		
Loss on loans	16,647,873.32		
Adjustment of valuation reserves	80,916,697.25	341,248,052.26	180,306,982.94
Total liabilities			183,211,969.52

[1] Includes $478,205.46 which is also included in investment in assets acquired in liquidation of loans, where such assets are on hand but which is included in loss on loans, where such assets acquired are no longer held.

NOTE.—Total commitments outstanding, Dec. 31, 1939, amounted to $1,485,000.

JOINT STOCK LAND BANKS

TABLE 80.—*Reduction in gross assets, and of bonds and notes payable during 1939, by banks*

Name and location of bank	Gross assets			Bonds and notes payable		
	Dec. 31, 1938	Dec. 31, 1939	Percent reduction, 1939	Dec. 31, 1938	Dec. 31, 1939	Percent reduction, 1939
Atlanta, Atlanta, Ga	$2,523,789	$2,008,102	20.4	$1,822,245	$1,314,231	27.9
Atlantic, Raleigh, N. C	3,410,572	2,323,604	31.9	1,364,500	956,500	29.9
California, San Francisco, Calif	201,207		100.0	41,000		100.0
Dallas, Dallas, Tex	16,145,069	13,201,503	18.2	10,215,000	7,186,000	29.7
Denver, Denver, Colo	6,461,051	5,002,090	22.6	4,576,945	3,131,870	31.6
Des Moines, Des Moines, Iowa	1,587,218	1,335,033	15.9	152,000	52,000	65.8
First Carolinas, Columbia, S. C	2,679,518	2,387,522	10.9	2,173,900	1,903,016	12.5
First, Fort Wayne, Ind	1,646,962	1,417,841	13.9	139,700	6,768	95.2
First, Montgomery, Ala	3,057,835	2,626,143	14.1	2,621,461	2,161,891	17.5
First, New Orleans, La	1,856,364	1,551,194	16.4	1,456,000	1,188,000	18.4
First Texas, Houston, Tex	3,653,011	3,160,910	13.5	3,032,051	2,624,944	13.4
First Trust, Chicago, Ill	28,486,283	25,354,251	11.0	22,624,000	19,833,000	12.3
Fletcher, Indianapolis, Ind	9,944,055	9,149,460	8.0	7,792,100	6,901,200	11.4
Fremont, Lincoln, Nebr	2,820,122	2,637,745	6.5	2,143,934	2,031,134	5.3
Greenbrier, Charleston, W. Va	195,469		100.0	4,500		100.0
Greensboro, Raleigh, N. C	1,241,079		100.0	410,000		100.0
Illinois, Monticello, Ill	610,818	463,102	24.2			
Illinois Midwest, Edwardsville, Ill	2,194,485	2,074,189	5.5	1,838,000	1,714,017	6.7
Indianapolis, Indianapolis, Ind	767,588	592,912	22.8	471,800	293,300	37.8
Iowa, Sioux City, Iowa	2,815,007	2,645,017	6.0	2,082,400	1,971,000	5.3
Kentucky, Lexington, Ky	2,497,609	1,642,380	34.2	75,000		100.0
La Fayette, La Fayette, Ind	3,808,944	3,449,119	9.4	3,232,800	2,833,400	12.4
Lincoln, Lincoln, Nebr	9,868,052	8,917,588	9.6	7,548,500	6,915,500	8.4
Louisville, Louisville, Ky	1,364,849	1,280,317	6.2	769,235	664,004	13.7
Minneapolis-Trust, Minneapolis, Minn	1,089,483	930,778	14.6	[1] 628,156	[2] 579,096	7.8
New York, Rochester, N. Y	5,807,438	5,346,422	7.9	4,776,000	4,583,000	4.0
North Carolina, Durham, N. C	6,017,272	5,362,175	10.9	4,487,000	3,821,788	14.8
Pacific Coast, Portland, Oreg	2,534,164	2,130,859	15.9	1,155,000	782,000	32.3
Pacific Coast, Salt Lake City, Utah	552,572	472,311	14.5			
Pennsylvania, Philadelphia, Pa	2,567,089	2,283,319	11.1	2,123,467	1,879,082	11.5
Phoenix, Kansas City, Mo	16,237,450	16,224,612	.1	12,374,341	12,210,367	1.3
Potomac, Washington, D. C	1,985,873	1,651,212	16.9	1,271,000	912,000	28.2
San Antonio, San Antonio, Tex	7,730,719	7,086,416	8.3	4,958,916	4,249,088	14.3
Southwest, Little Rock, Ark	2,204,755	2,011,576	8.8	1,966,909	1,794,414	8.8
Union, Detroit, Mich	6,285,333	7,918,561	+26.0	5,075,500	6,908,423	+36.1
Union Trust, Indianapolis, Ind	525,543	434,090	17.4	93,500		100.0
Virginia-Carolina, Elizabeth City, N. C	1,948,413	1,401,613	28.1	1,206,398	673,774	44.1
Virginian, Charleston, W. Va	4,225,955	3,708,598	12.2	2,962,658	2,406,955	18.8
Total	169,549,015	150,182,564	11.4	119,665,916	104,481,762	12.7

[1] Includes $618,156 certificates of participation.
[2] Includes $569,096 certificates of participation.

JOINT STOCK LAND BANKS

TABLE 81.—*Changes in amount of purchase money mortgages, contracts, etc., and of real estate, sheriffs' certificates, and judgments during 1939, by banks*

Name and location of bank	Purchase money mortgages, contracts, etc.			Real estate, sheriffs' certificates, and judgments		
	Dec. 31, 1938	Dec. 31, 1939	Percent change, 1939	Dec. 31, 1938	Dec. 31, 1939	Percent change, 1939
Atlanta, Atlanta, Ga	$574,916	$539,634	−6.1	$520,471	$436,978	−16.0
Atlantic, Raleigh, N. C	798,659	499,699	−37.4	108,949	167,207	53.5
California, San Francisco, Calif	126,101		−100.0	1		−100.0
Dallas, Dallas, Tex	2,528,034	1,280,070	−49.4	3,072,396	2,576,021	−16.2
Denver, Denver, Colo	1,307,841	1,166,393	−10.8	1,484,915	1,223,162	−17.6
Des Moines, Des Moines, Iowa	245,450	306,162	24.7	1,654,631	1,256,669	−24.1
First Carolinas, Columbia, S. C	1,049,675	871,784	−16.9	566,955	325,761	−42.5
First, Fort Wayne, Ind	553,188	528,143	−4.5	515,851	439,613	−14.8
First, Montgomery, Ala	545,486	571,533	4.8	391,347	245,485	−37.3
First, New Orleans, La	476,514	397,443	−16.6	316,881	221,281	−30.2
First Texas, Houston, Tex	354,831	367,863	3.7	1,347,382	1,391,801	3.3
First Trust, Chicago, Ill	2,109,573	2,370,432	12.4	13,878,073	13,152,059	−5.2
Fletcher, Indianapolis, Ind	402,907	482,063	19.6	991,571	911,752	−8.0
Fremont, Lincoln, Nebr	335,722	402,760	20.0	2,479,171	2,262,252	−8.7
Greenbrier, Charleston, W. Va	7,327		−100.0	13,216		−100.0
Greensboro, Raleigh, N. C	265,612		−100.0	143,494		−100.0
Illinois, Monticello, Ill	42,725	45,180	5.7	388,566	290,432	−25.3
Illinois Midwest, Edwardsville, Ill	231,718	282,246	21.8	1,280,377	1,103,941	−13.8
Indianapolis, Indianapolis, Ind	14,334	9,132	−36.3	4,927	4,927	
Iowa, Sioux City, Iowa	320,075	515,874	61.2	1,666,380	1,494,460	−10.3
Kentucky, Lexington, Ky	212,856	122,773	−42.3	64,413	32,137	−50.1
La Fayette, La Fayette, Ind	547,426	636,872	16.3	964,699	799,491	−17.1
Lincoln, Lincoln, Nebr	1,183,030	1,334,975	12.8	6,780,374	6,177,612	−8.9
Louisville, Louisville, Ky	751,801	696,036	−7.4	187,203	196,778	5.1
Minneapolis-Trust, Minneapolis, Minn	107,095	132,176	23.4	979,605	899,773	−8.1
New York, Rochester, N. Y	1,292,053	1,473,863	14.1	1,767,587	1,161,069	−34.3
North Carolina, Durham, N. C	1,915,524	1,615,669	−15.7	881,975	749,299	−15.0
Pacific Coast, Portland, Oreg	591,036	675,739	14.3	518,728	346,425	−33.2
Pacific Coast, Salt Lake City, Utah	337,069	241,791	−28.3	172,163	149,175	−13.4
Pennsylvania, Philadelphia, Pa	292,299	296,664	1.5	236,180	154,206	−34.7
Phoenix, Kansas City, Mo	362,706	330,734	−8.8	2,440,671	2,265,543	−7.2
Potomac, Washington, D. C	348,282	254,497	−26.9	111,205	109,301	−1.7
San Antonio, San Antonio, Tex	519,190	769,213	48.2	2,682,396	2,431,419	−9.4
Southwest, Little Rock, Ark	300,962	333,459	10.8	815,408	742,350	−9.0
Union, Detroit, Mich	1,350,228	1,200,584	−11.1	1,018,183	731,588	−28.1
Union Trust, Indianapolis, Ind	11,106	10,715	−3.5	10,540	6,759	−35.9
Virginia-Carolina, Elizabeth City, N. C	610,488	476,881	−21.9	71,002	109,396	54.1
Virginian, Charleston, W. Va	1,012,200	973,424	−3.8	448,814	320,600	−28.6
Total	24,036,039	22,212,476	−7.6	50,976,700	44,886,722	−11.9

JOINT STOCK LAND BANKS

TABLE 82.—*Reduction in mortgage loans during 1939, by banks*

Name and location of bank	Amounts outstanding		Percent reduction during 1939					
	Dec. 31, 1938	Dec. 31, 1939	Total	Loans refinanced, sold, or paid in full	Amortization and special payments	Charged to profit and loss	Foreclosure or voluntary deed	Other
Atlanta, Atlanta, Ga	$1,231,739	$1,024,333	16.8	11.0	3.7		2.1	
Atlantic, Raleigh, N. C	2,023,669	1,583,112	21.8	18.1	3.5		.2	
Dallas, Dallas, Tex	9,693,083	2,436,859	74.9	69.5	2.6	.2	2.8	+.2
Denver, Denver, Colo	2,991,532	2,714,947	9.2	4.7	3.4	.2	1.0	+.1
Des Moines, Des Moines, Iowa	238,586	167,614	29.7	2.1	2.1	.4	25.1	
First Carolinas, Columbia, S. C	1,176,093	1,083,091	7.9	4.8	4.5	.1	1.8	+3.3
First, Fort Wayne, Ind	614,845	452,356	26.4	21.8	3.2		1.4	
First, Montgomery, Ala	1,905,430	1,708,508	10.3	5.6	3.4	.2	1.1	
First, New Orleans, La	934,406	760,572	18.6	15.3	3.3			
First Texas, Houston, Tex	1,951,191	1,532,695	21.4	6.4	3.9		12.0	+.9
First Trust, Chicago, Ill	14,017,268	10,738,107	23.4	9.7	3.0	.1	10.8	+.2
Fletcher, Indianapolis, Ind	8,095,069	7,139,949	11.8	7.9	2.7		1.6	+.4
Fremont, Lincoln, Nebr	414,390	355,264	14.3	4.7	2.8		6.8	
Greenbrier, Charleston, W. Va	164,691		100.0	100.0				
Greensboro, Raleigh, N. C	411,796		100.0	95.4	.9	.1	3.6	
Illinois, Monticello, Ill	174,370	129,169	25.9	22.0	2.1		1.8	
Illinois Midwest, Edwardsville, Ill	897,230	801,871	10.6	6.5	3.2		.9	
Indianapolis, Indianapolis, Ind	356,087	295,040	17.1	14.0	3.1			
Iowa, Sioux City, Iowa	715,306	457,409	36.1	14.2	3.6		18.9	+.6
Kentucky, Lexington, Ky	2,196,141	1,070,601	51.3	45.6	3.9	+.1	1.9	
La Fayette, La Fayette, Ind	2,272,790	2,028,903	10.7	7.2	2.8		1.1	+.4
Lincoln, Lincoln, Nebr	2,941,728	2,371,877	19.4	3.0	2.0	.1	14.3	
Louisville, Louisville, Ky	444,955	386,720	13.1	5.8	3.3		4.0	
Minneapolis-Trust, Minneapolis, Minn	55,172	39,377	28.6	3.7	3.1	10.4	11.4	
New York, Rochester, N. Y	2,825,215	2,530,355	10.4	3.7	3.9	.1	2.7	
North Carolina, Durham, N. C	2,991,528	2,707,446	9.5	5.8	3.4		.3	
Pacific Coast, Portland, Oreg	1,301,372	904,888	30.5	21.2	3.1		6.2	
Pacific Coast, Salt Lake City, Utah	68,259	19,405	71.6	62.8	7.5	1.4	3.4	+3.5
Pennsylvania, Philadelphia, Pa	1,912,028	1,611,593	15.7	7.9	3.7	.1	4.0	
Phoenix, Kansas City, Mo	4,633,799	3,974,887	14.2	5.6	3.9	.2	6.7	+2.2
Potomac, Washington, D. C	1,323,196	1,152,793	12.9	8.5	3.6		.8	
San Antonio, San Antonio, Tex	4,561,258	3,764,447	17.5	10.0	2.9		6.0	+1.4
Southwest, Little Rock, Ark	1,226,416	983,839	19.8	8.6	2.8		8.4	
Union, Detroit, Mich	3,837,662	3,431,586	10.6	5.7	4.0		1.6	+.7
Union Trust, Indianapolis, Ind	278,377	228,740	17.8	13.9	2.6		1.3	
Virginia-Carolina, Elizabeth City, N. C	1,113,745	768,167	31.0	22.7	2.6	.8	4.9	
Virginian, Charleston, W. Va	2,534,231	2,166,799	14.5	7.7	4.8		2.0	
Total	84,524,653	63,523,319	24.8	17.1	3.2	.1	4.9	+.5

JOINT STOCK LAND BANKS

TABLE 83.—*Classification of mortgage loans, purchase money mortgages, real-estate sales contracts, and notes receivable outstanding Dec. 31, 1939, by banks*

Name and location of bank	Mortgage loans				Purchase money mortgages, real-estate sales contracts, and notes receivable		
	Total number outstanding	Percent of total			Total number outstanding	Percent of total	
		Not delinquent	Delinquent	In suspense		Not delinquent	Delinquent
Atlanta, Atlanta, Ga	297	76.4	22.6	1.0	280	71.4	28.6
Atlantic, Raleigh, N. C	832	94.8	4.5	.7	352	84.9	15.1
Dallas, Dallas, Tex	503	64.2	16.3	19.5	384	70.6	29.4
Denver, Denver, Colo	604	74.2	15.7	10.1	332	63.9	36.1
Des Moines, Des Moines, Iowa	25	72.0	12.0	16.0	104	86.5	13.5
First Carolinas, Columbia, S. C	382	93.7	4.2	2.1	532	78.2	21.8
First, Fort Wayne, Ind	135	75.6	20.0	4.4	161	94.4	5.6
First, Montgomery, Ala	469	87.4	11.7	.9	187	70.6	29.4
First, New Orleans, La	93	87.1	11.8	1.1	98	77.6	22.4
First Texas, Houston, Tex	322	67.1	25.1	7.8	92	72.8	27.2
First Trust, Chicago, Ill	1,843	95.0	3.5	1.5	475	95.6	4.4
Fletcher, Indianapolis, Ind	1,935	91.4	4.4	4.2	126	92.9	7.1
Fremont, Lincoln, Nebr	68	85.3	10.3	4.4	63	79.4	20.6
Illinois, Monticello, Ill	21	95.2	-------	4.8	9	77.8	22.2
Illinois Midwest, Edwardsville, Ill	179	95.0	2.8	2.2	74	98.6	1.4
Indianapolis, Indianapolis, Ind	104	92.3	7.7	-------	3	100.0	---
Iowa, Sioux City, Iowa	63	77.8	22.2	-------	70	91.4	8.6
Kentucky, Lexington, Ky	386	92.5	4.4	3.1	62	90.3	9.7
La Fayette, La Fayette, Ind	520	79.1	16.7	4.2	101	54.5	45.5
Lincoln, Lincoln, Nebr	361	82.3	16.3	1.4	194	82.5	17.5
Louisville, Louisville, Ky	168	98.8	.6	.6	206	94.2	5.8
Minneapolis-Trust, Minneapolis, Minn	9	44.4	55.6	-------	61	50.8	49.2
New York, Rochester, N. Y	861	73.5	22.0	4.5	502	67.1	32.9
North Carolina, Durham, N. C	1,368	96.8	3.0	.2	813	78.2	21.8
Pacific Coast, Portland, Oreg	100	36.0	59.0	5.0	100	52.0	48.0
Pacific Coast, Salt Lake City, Utah	8	12.5	37.5	50.0	81	23.5	76.5
Pennsylvania, Philadelphia, Pa	660	78.6	19.3	2.1	207	67.1	32.9
Phoenix, Kansas City, Mo	1,208	86.4	10.3	3.3	132	90.9	9.1
Potomac, Washington, D. C	439	87.2	11.4	1.4	124	62.9	37.1
San Antonio, San Antonio, Tex	858	77.2	10.1	12.7	302	86.8	13.2
Southwest, Little Rock, Ark	247	68.8	23.1	8.1	155	77.4	22.6
Union, Detroit, Mich	1,377	78.1	21.3	.6	559	69.8	30.2
Union Trust, Indianapolis, Ind	74	78.4	13.5	8.1	3	100.0	-------
Virginia-Carolina, Elizabeth City, N. C	333	91.0	6.3	2.7	242	74.4	25.6
Virginian, Charleston, W. Va	980	85.6	9.1	5.3	456	77.4	22.6
Total	17,832	85.0	11.1	3.9	7,642	76.8	23.2

JOINT STOCK LAND BANKS

TABLE 84.—*Loans outstanding, and real estate, sheriffs' certificates, and judgments held, Dec. 31, 1939, by States* [1]

State	Loans outstanding		Real estate, sheriffs' certificates, and judgments held		
	Number	Unmatured principal	Number	Investment	Carrying value
Alabama	288	$1,026,494	17	$108,237	$70,638
Arizona					
Arkansas	199	818,019	20	138,454	105,413
California					
Colorado	353	1,506,706	162	892,957	651,241
Connecticut					
Delaware					
Florida					
Georgia	478	1,685,925	89	574,372	467,824
Idaho	7	13,856	20	92,948	83,241
Illinois	1,037	6,064,088	390	4,602,511	4,041,440
Indiana	2,808	10,043,100	252	2,160,497	1,875,479
Iowa	626	4,827,130	1,082	12,632,179	10,327,155
Kansas	605	2,124,128	305	1,664,488	1,539,876
Kentucky	128	302,251	15	108,479	67,487
Louisiana	17	138,932	9	71,526	70,176
Maine					
Maryland	74	298,863	11	49,342	30,940
Massachusetts					
Michigan	310	895,898	47	323,525	277,129
Minnesota	9	66,970	85	558,927	380,285
Mississippi	76	620,931	15	151,655	138,468
Missouri	452	1,408,389	196	1,019,853	732,997
Montana	43	188,564	38	222,136	83,444
Nebraska	276	1,459,541	639	5,939,597	5,085,852
Nevada					
New Hampshire					
New Jersey	124	376,971	9	113,647	75,777
New Mexico					
New York	868	2,324,961	186	1,124,334	943,184
North Carolina	2,437	4,862,829	187	934,577	771,286
North Dakota	9	38,836	[2] 131	[2] 730,169	[2] 591,205
Ohio	1,644	4,383,400	121	631,485	532,377
Oklahoma	259	794,625	123	750,691	478,465
Oregon	86	718,566	30	320,720	256,074
Pennsylvania	860	2,034,637	72	202,862	150,568
Rhode Island					
South Carolina	379	1,014,300	55	334,976	231,047
South Dakota	47	281,165	124	1,131,533	1,095,018
Tennessee					
Texas	2,216	9,798,042	822	6,899,637	5,465,237
Utah	1	353	10	56,227	26,002
Vermont					
Virginia	528	1,226,194	32	180,610	142,363
Washington	14	108,979	4	25,705	25,205
West Virginia	366	517,133	11	28,596	20,411
Wisconsin					
Wyoming	208	975,581	16	109,270	77,374
Total	17,832	62,946,357	5,325	44,886,722	36,910,678

[1] Excludes banks in receivership.

[2] Includes 1 property situated in the Province of Manitoba, Canada, in which the investment is $2,000 and carrying value $500.

JOINT STOCK LAND BANKS

TABLE 85.—*Real estate and sheriffs' certificates acquired and disposed of during 1939, by banks*

Name and location of bank	Total acquirements of real estate and sheriffs' certificates		Total disposals of real estate and sheriffs' certificates				
			Number		Investment	Consideration as percent of—	
	Number	Investment	Whole	Part		Investment	Carrying value
Atlanta, Atlanta, Ga	19	$56,362	31	17	$133,904	69.9	78.9
Atlantic, Raleigh, N. C	16	103,400	19	3	45,811	104.4	122.1
California, San Francisco, Calif	1	2,325	2		2,326	100.0	100.0
Dallas, Dallas, Tex	49	306,335	110	15	802,931	77.0	103.9
Denver, Denver, Colo	30	93,869	66	11	351,616	65.0	94.4
Des Moines, Des Moines, Iowa	9	68,723	62	6	549,125	65.8	87.6
First Carolinas, Columbia, S. C	15	38,549	48	39	279,886	57.5	100.1
First, Fort Wayne, Ind	28	99,572	40	8	187,762	117.2	131.7
First, Montgomery, Ala	13	37,689	27	7	183,750	71.5	99.8
First, New Orleans, La	6	34,550	8	7	132,003	78.8	105.6
First Texas, Houston, Tex	25	245,623	23	5	201,204	93.7	112.9
First Trust, Chicago, Ill	159	1,630,372	250	25	2,393,967	79.0	94.6
Fletcher, Indianapolis, Ind	22	156,128	34	5	237,244	90.3	101.5
Fremont, Lincoln, Nebr	6	42,755	29	2	262,406	81.7	92.1
Greenbrier, Charleston, W. Va.[1]							
Greensboro, Raleigh, N. C.[2]	2	18,669	13	3	46,292	54.8	71.1
Illinois, Monticello, Ill	1	2,995	9	1	101,128	104.2	119.8
Illinois Midwest, Edwardsville, Ill	4	11,844	26	5	189,655	84.4	108.4
Indianapolis, Indianapolis, Ind							
Iowa, Sioux City, Iowa	14	150,794	29	8	324,155	92.4	96.0
Kentucky, Lexington, Ky	6	33,604	7	1	65,880	79.7	134.3
La Fayette, La Fayette, Ind	10	88,149	26	6	255,730	108.9	119.9
Lincoln, Lincoln, Nebr	55	498,767	102	23	1,108,137	80.1	92.5
Louisville, Louisville, Ky	5	34,291	10		24,805	96.6	112.7
Minneapolis-Trust, Minneapolis, Minn	3	10,826	14	3	87,975	65.0	76.9
New York, Rochester, N. Y	53	195,050	134	7	803,946	64.3	82.9
North Carolina, Durham, N. C	57	196,634	78	27	331,855	79.7	90.8
Pacific Coast, Portland, Oreg	16	160,489	32		331,385	90.5	110.6
Pacific Coast, Salt Lake City, Utah	7	42,092	13	1	65,080	68.1	90.5
Pennsylvania, Philadelphia, Pa	35	82,490	65	5	163,939	78.1	97.1
Phoenix, Kansas City, Mo	59	338,647	75	6	515,224	64.6	80.6
Potomac, Washington, D. C	9	48,119	11	4	50,339	96.4	119.6
San Antonio, San Antonio, Tex	45	308,261	87	14	565,835	85.9	113.4
Southwest, Little Rock, Ark	15	107,579	33	17	182,161	90.1	109.0
Union, Detroit, Mich	36	100,489	103	38	393,708	88.7	98.2
Union Trust, Indianapolis, Ind	1	1,966	1		5,747	104.4	147.7
Virginia-Carolina, Elizabeth City, N. C	20	164,013	24	1	128,440	107.7	132.6
Virginian, Charleston, W. Va	36	132,918	58	8	264,259	93.5	115.1
Total	887	5,644,938	1,699	328	11,769,610	79.8	98.2

[1] Data are not available subsequent to Dec. 31, 1938. Dissolved, Mar. 17, 1939.

[2] Data are not available subsequent to Mar. 18, 1939, on which date final liquidating dividend was approved. Due to litigation, charter has not yet been canceled.

JOINT STOCK LAND BANKS

TABLE 86.—*Bonds issued and retired during 1939, and outstanding, Dec. 31, 1939, by banks*

Name and location of bank	Bonds issued during 1939	Bonds retired during 1939	Bonds outstanding		
			Held by issuing bank	Held by investors	Total
Atlanta, Atlanta, Ga	$200,000	$679,000		$965,000	$965,000
Atlantic, Raleigh, N. C	937,000	1,345,000		956,500	956,500
California, San Francisco, Calif		41,000			
Dallas, Dallas, Tex		3,029,000		7,186,000	7,186,000
Denver, Denver, Colo	250,000	1,214,500		2,739,000	2,739,000
Des Moines, Des Moines, Iowa				32,000	32,000
First Carolinas, Columbia, S. C		504,000		1,696,500	1,696,500
First, Fort Wayne, Ind		98,400		6,300	6,300
First, Montgomery, Ala		397,000	$13,000	1,720,000	1,733,000
First, New Orleans, La		268,000		1,188,000	1,188,000
First Texas, Houston, Tex		392,000		2,613,000	2,613,000
First Trust, Chicago, Ill		2,791,000		19,833,000	19,833,000
Fletcher, Indianapolis, Ind		795,900	320,000	6,746,200	7,066,200
Fremont, Lincoln, Nebr		113,500		1,584,400	1,584,400
Greenbrier, Charleston, W. Va		4,500			
Greensboro, Raleigh, N. C		410,000			
Illinois, Monticello, Ill					
Illinois Midwest, Edwardsville, Ill		295,000		1,204,000	1,204,000
Indianapolis, Indianapolis, Ind		193,500		278,300	278,300
Iowa, Sioux City, Iowa		183,400		1,971,000	1,971,000
Kentucky, Lexington, Ky		420,000			
La Fayette, La Fayette, Ind		541,700		2,623,300	2,623,300
Lincoln, Lincoln, Nebr		675,000		6,315,500	6,315,500
Louisville, Louisville, Ky				5,000	5,000
Minneapolis-Trust, Minneapolis, Minn		[1] 49,060		[2] 579,096	[2] 579,096
New York, Rochester, N. Y		193,000		4,583,000	4,583,000
North Carolina, Durham, N. C	150,000	414,000		2,829,000	2,829,000
Pacific Coast, Portland, Oreg		398,000	257,000	782,000	1,039,000
Pacific Coast, Salt Lake City, Utah					
Pennsylvania, Philadelphia, Pa	1,584,000	1,842,000		1,653,000	1,653,000
Phoenix, Kansas City, Mo.[3]		20,125		12,050,367	12,050,367
Potomac, Washington, D. C	900,000	1,259,000		912,000	912,000
San Antonio, San Antonio, Tex	2,900,000	3,586,500		3,585,000	3,585,000
Southwest, Little Rock, Ark		137,000		1,643,900	1,643,900
Union, Detroit, Mich	2,700,000	1,973,500	8,000	5,802,000	5,810,000
Union Trust, Indianapolis, Ind		93,500			
Virginia-Carolina, Elizabeth City, N. C	693,000	1,053,000	148,000	603,000	751,000
Virginian, Charleston, W. Va	2,050,000	2,402,900		2,185,500	2,185,500
Total	12,364,000	27,812,985	746,000	96,870,863	97,616,863

[1] Certificates of participation.
[2] Includes certificates of participation.
[3] Includes fractional certificates.

JOINT STOCK LAND BANKS

TABLE 87.—*Condensed statements of condition, Dec. 31, 1939, by banks*

ASSETS

Name and location of bank	Mortgage loans (net)	Purchase money mortgages, contracts, etc. (net)	Delinquent installments (net)	Cash and securities	Real estate, sheriffs' certificates, and judgments (net)	Other (net)	Total assets
Atlanta, Atlanta, Ga	$1,013,315	$539,634	$19,692	$40,983	$368,074	$21,782	$2,003,480
Atlantic, Raleigh, N. C	1,580,647	499,699	5,185	28,565	149,550	59,753	2,323,399
Dallas, Dallas, Tex	2,373,083	1,280,070	45,974	7,432,109	1,984,241	64,002	13,179,479
Denver, Denver, Colo	2,667,463	1,166,393		226,194	810,859	49,805	4,920,714
Des Moines, Des Moines, Iowa	162,937	306,162	2,679	18,700	829,924	10,131	1,331,533
First Carolinas, Columbia, S. C	1,074,327	871,784	4,698	156,676	222,571	30,376	2,360,432
First, Fort Wayne, Ind	448,363	528,143	5,619	65,889	332,650	9,518	1,390,182
First, Montgomery, Ala	1,698,766	571,533	14,990	120,411	170,242	47,165	2,623,107
First, New Orleans, La	757,728	397,443	4,384	157,129	207,894	25,478	1,550,056
First Texas, Houston, Tex	1,494,911	367,863	55,172	159,608	1,043,030	22,168	3,142,752
First Trust, Chicago, Ill	10,714,956	2,370,432	15,704	641,421	11,404,599	182,569	25,329,681
Fletcher, Indianapolis, Ind	7,111,299	482,063	2,743	435,887	859,862	222,606	9,114,460
Fremont, Lincoln, Nebr	354,040	402,760	2,553	15,950	1,855,085	7,357	2,637,745
Illinois, Monticello, Ill	128,424	45,180		10,797	275,063	3,237	462,701
Illinois Midwest, Edwardsville, Ill	800,119	282,246	1,471	77,662	893,264	19,426	2,074,188
Indianapolis, Indianapolis, Ind	294,514	9,132	1,598	264,507	4,927	18,234	592,912
Iowa, Sioux City, Iowa	455,962	515,874	3,975	223,151	1,438,438	7,417	2,644,817
Kentucky, Lexington, Ky	1,068,900	122,773	956	414,924	11,750	21,639	1,640,942
La Fayette, La Fayette, Ind	2,005,991	636,872	39,408	37,617	673,094	36,137	3,429,119
Lincoln, Lincoln, Nebr	2,360,804	1,334,975	19,755	202,962	4,935,624	58,080	8,912,200
Louisville, Louisville, Ky	386,662	696,036	121	33,258	155,239	9,001	1,280,317
Minneapolis-Trust, Minneapolis, Minn	38,836	132,176	1,451	45,137	710,727	2,451	930,778
New York, Rochester, N. Y	2,471,000	1,473,863	5,176	354,682	959,714	34,575	5,299,010
North Carolina, Durham, N. C	2,704,202	1,615,669	7,348	362,002	597,551	72,563	5,359,335
Pacific Coast, Portland, Oreg	826,825	675,739	91,720	139,303	281,279	42,547	2,057,413
Pacific Coast, Salt Lake City, Utah	14,208	241,791		96,958	109,243	3,039	465,239
Pennsylvania, Philadelphia, Pa	1,599,097	296,664	24,676	212,401	111,891	37,689	2,282,418

Phoenix, Kansas City, Mo	3,946,387	330,734		9,786,871	2,009,554	116,120	16,189,666
Potomac, Washington, D. C	1,149,173	254,497	3,434	127,500	85,600	22,080	1,642,284
San Antonio, San Antonio, Tex	3,724,082	769,213		448,900	1,911,256	193,538	7,046,989
Southwest, Little Rock, Ark	961,391	333,459	6,303	131,590	528,172	21,868	1,982,783
Union, Detroit, Mich	3,406,679	1,200,584	12,955	2,530,422	629,212	70,230	7,850,082
Union Trust, Indianapolis, Ind	227,873	10,715		181,653	6,759	5,454	432,454
Virginia-Carolina, Elizabeth City, N. C	760,901	476,881	5,799	24,091	99,123	31,490	1,398,285
Virginian, Charleston, W. Va	2,092,840	973,424	23,490	233,251	244,617	93,104	3,660,726
Total	62,877,705	22,212,476	429,029	25,439,161	36,910,678	1,672,629	149,541,678

JOINT STOCK LAND BANKS

TABLE 87.—*Condensed statements of condition, Dec. 31, 1939, by banks*—Continued

LIABILITIES

Name and location of bank	Farm loan bonds	Notes payable	Miscellaneous liabilities	Capital stock	Surplus, reserves, and undivided profits	Total liabilities
Atlanta, Atlanta, Ga	$965,000	$349,231	$49,950	$350,000	$289,299	$2,003,480
Atlantic, Raleigh, N. C	956,500		587,273	907,500	−127,874	2,323,399
Dallas, Dallas, Tex	7,186,000		236,441	2,421,200	3,335,838	13,179,479
Denver, Denver, Colo	2,739,000	392,870	127,827	1,184,800	476,217	4,920,714
Des Moines, Des Moines, Iowa	32,000	20,000	26,808	1,091,700	161,025	1,331,533
First Carolinas, Columbia, S. C	1,696,500	206,516	63,927	785,000	−391,511	2,360,432
First, Fort Wayne, Ind	6,300	468	26,433	400,000	956,981	1,390,182
First, Montgomery, Ala	1,720,000	441,891	53,924	550,000	−142,708	2,623,107
First, New Orleans, La	1,188,000		39,342	250,000	72,714	1,550,056
First Texas, Houston, Tex	2,613,000	11,944	79,400	550,000	−111,592	3,142,752
First Trust, Chicago, Ill	19,833,000		511,830	4,600,000	384,851	25,329,681
Fletcher, Indianapolis, Ind	6,746,200	155,000	94,270	750,000	1,368,990	9,114,460
Fremont, Lincoln, Nebr	1,584,400	446,734	52,578	850,000	−295,967	2,637,745
Illinois, Monticello, Ill			13,364	[1] 449,337		462,701
Illinois Midwest, Edwardsville, Ill	1,204,000	510,017	40,296	350,000	−30,125	2,074,188
Indianapolis, Indianapolis, Ind	278,300	15,000	6,476	250,000	43,136	592,912
Iowa, Sioux City, Iowa	1,971,000		51,065	500,000	122,752	2,644,817
Kentucky, Lexington, Ky			9,046	[2] 1,631,896		1,640,942
La Fayette, La Fayette, Ind	2,623,300	210,100	135,202	300,000	159,517	3,429,119
Lincoln, Lincoln, Nebr	6,315,500	600,000	222,046	2,711,400	−936,746	8,912,200
Louisville, Louisville, Ky	5,000	659,004	59,277	500,000	57,036	1,280,317
Minneapolis-Trust, Minneapolis, Minn	[3] 579,096		268,045	450,000	−366,363	930,778
New York, Rochester, N. Y	4,583,000		149,606	800,000	−233,596	5,299,010
North Carolina, Durham, N. C	2,829,000	992,788	90,448	700,000	747,099	5,359,335
Pacific Coast, Portland, Oreg	782,000		119,759	450,000	705,654	2,057,413
Pacific Coast, Salt Lake City, Utah			28,229	300,000	137,010	465,239
Pennsylvania, Philadelphia, Pa	1,653,000	226,082	37,768	418,500	−52,932	2,282,418
Phoenix, Kansas City, Mo	12,050,367	160,000	100,211	1,650,000	2,229,088	16,189,666

Potomac, Washington, D. C	912,000		16,826	400,000	313,458	1,642,284
San Antonio, San Antonio, Tex	3,585,000	664,088	137,332	1,226,500	1,434,069	7,046,989
Southwest, Little Rock, Ark	1,643,900	150,514	66,557	285,000	−163,188	1,982,783
Union, Detroit, Mich	5,802,000	1,106,423	188,018	1,370,000	−616,359	7,850,082
Union Trust, Indianapolis, Ind			955	250,000	181,499	432,454
Virginia-Carolina, Elizabeth City, N. C	603,000	70,774	48,833	400,000	275,678	1,398,285
Virginian, Charleston, W. Va	2,185,500	221,455	109,862	1,150,000	−6,091	3,660,726
Total	96,870,863	7,610,899	3,850,224	31,232,833	9,976,859	149,541,678

[1] Represents net amount of capital and net worth accounts after deducting $337,500 liquidating dividends.
[2] Represents net amount of capital and net worth accounts after deducting $877,500 liquidating dividends.
[3] Includes $569,096 certificates of participation.

JOINT STOCK LAND BANKS IN RECEIVERSHIP

TABLE 88.—*Condition of loans outstanding, Dec. 31, 1939* [1]

Name and location of bank	In default		Not in default		Total	
	Number	Book amount	Number	Book amount	Number	Book amount
Burlington, Des Moines, Iowa	3	$5,482	11	$41,115	14	$46,597
Chicago, Des Moines, Iowa	6	53,227	32	156,658	38	209,885
Northwest, Portland, Oreg.						
Oregon-Washington, Portland, Oreg.	35	250,952	60	328,429	95	579,381
St. Louis, St. Louis, Mo.	15	28,610	572	1,481,957	587	1,510,567
Southern Minnesota, Minneapolis, Minn.	25	79,839	75	251,293	100	331,132
Total	84	418,110	750	2,259,452	834	2,677,562

[1] Excludes loans in process of foreclosure.

TABLE 89.—*Loans, purchase money mortgages, and other specified assets held, Dec. 31, 1939, by banks and by States*

Bank and State	Loans outstanding		Purchase money mortgages, real-estate sales contracts, and notes receivable		Real estate owned outright		Sheriffs' certificates and judgments	
	Number	Book amount	Number	Book amount	Number	Book amount	Number	Book amount
Burlington:								
Illinois	10	$67,106	5	$16,184	4	$21,023		
Iowa	6	10,795	6	9,950	1	16,012		
Total	16	77,901	11	26,134	5	37,035		
Chicago:								
Illinois	20	135,793	28	142,673	20	198,751		
Iowa	23	128,294	138	618,096	132	1,461,729	23	$204,682
South Dakota					1	1,600		
Total	43	264,087	166	760,769	153	1,662,080	23	204,682
Northwest:								
Oregon					2	751		
Washington					1	2,000		
Total					3	2,751		
Oregon-Washington:								
Oregon	62	384,048	73	432,868	49	355,133	1	6,779
Washington	33	195,333	23	117,612	5	26,600		
Total	95	579,381	96	550,480	54	381,733	1	6,779

JOINT STOCK LAND BANKS IN RECEIVERSHIP

TABLE 89.—*Loans, purchase money mortgages, and other specified assets held, Dec. 31, 1939, by banks and by States*—Continued

Bank and State	Loans outstanding		Purchase money mortgages, real estate sales contracts, and notes receivable		Real estate owned outright		Sheriffs' certificates and judgments	
	Number	Book amount	Number	Book amount	Number	Book amount	Number	Book amount
St. Louis:								
Arkansas	129	$648,502	180	$437,405	7	$77,604	2	$10,741
Illinois	306	459,383	173	218,657	25	92,728	15	39,100
Indiana	28	46,108	22	22,723	1	5,106		
Missouri	129	366,288	194	334,340	10	87,871		
Total	592	1,520,281	569	1,013,125	43	263,309	17	49,841
Southern Minnesota:								
California			1	523				
Iowa			2	6,420				
Minnesota	82	260,091	330	1,258,032	328	2,707,992	2	2,677
North Dakota					1	1		
South Dakota	18	71,041	55	179,000	616	4,588,566	1	9,000
Total	100	331,132	388	1,443,975	945	7,296,559	3	11,677
Grand total	846	2,772,782	1,230	3,794,483	1,203	9,643,467	44	272,979

JOINT STOCK LAND BANKS IN RECEIVERSHIP

TABLE 90.—*Statements of condition of banks in receivership, Dec. 31, 1939*

	Burlington		Chicago		Northwest	
ASSETS						
Gross mortgage loans	$103,400.00		$361,100.00			
Less repayments on principal	25,498.60	$77,901.40	97,013.42	$264,086.58		
United States Government obligations, direct and fully guaranteed—par value (held by Federal Reserve banks subject to the order of the Governor of the Farm Credit Administration)						
Cash on hand and in banks		510.82		21,874.48		$7,751.95
Cash on deposit with the Treasurer of the United States		55,886.95		161,281.95		
Cash in United States Treasury—Dividend account		11,777.67		104,460.32		
Cash in United States Treasury—Coupons matured prior to date of receivership				37,022.50		
Accounts receivable:						
Tax advances [1]			158.43			
Insurance advances [1]			86.65			
Other advances [1]			49.00	294.08	$100.00	100.00
Purchase money mortgages and contracts:						
Purchase money first mortgages	15,100.00		214,913.60			
Purchase money second mortgages			2,963.79			
Real-estate sales contracts	11,034.25		542,891.44			
Real-estate notes receivable		26,134.25		760,768.83		
Real estate owned outright		37,035.10		1,662,080.30		2,751.00
Sheriffs' certificates, judgments, etc				204,682.14		
Furniture, fixtures, equipment, etc		11.30		10,421.61		
Other assets		158.37		10,250.42		1,875.00
Total assets [2]		209,415.86		3,237,223.21		12,477.95

LIABILITIES						
Farm loan bonds:						
4¼ percent	$32,600.00					
4½ percent	236,300.00		$13,195,000.00			
4¾ percent			9,938,000.00			
5 percent	398,500.00		15,803,100.00			
5½ percent			3,788,000.00			
Total	667,400.00		42,724,100.00			
Less liquidation dividend	[3] 300,330.00	$367,070.00	[4] 33,324,470.50	$9,399,629.50		
Interest on farm loan bonds:						
Unpaid interest maturing prior to date of receivership	3,564.35		134,955.00			
Unmatured interest accrued to date of receivership	6,620.52		747,672.91			
Total	10,184.87		882,627.91			
Less liquidation dividend	[3] 4,583.20	5,601.67	[4] 688,443.02	194,184.89		
Dividends payable		11,777.67		104,460.32		
Trust accounts:						
Unpaid interest maturing prior to date of receivership			37,160.00			
Other trust accounts			15,047.61	52,207.61	$2,210.83	$2,210.83
Other liabilities		164.30		3,117.96		998.52
Total liabilities [2]		384,613.64		9,753,600.28		3,209.35

See footnotes at end of table.

JOINT STOCK LAND BANKS IN RECEIVERSHIP

TABLE 90.—*Statements of condition of banks in receivership, Dec. 31, 1939*—Continued

	Oregon-Washington		St. Louis		Southern Minnesota	
ASSETS						
Gross mortgage loans	$793,019.90		$2,107,400.00		$474,200.00	
Less repayments on principal	213,638.62	$579,381.28	587,118.67	$1,520,281.33	143,068.05	$331,131.95
U. S. Government obligations, direct and fully guaranteed—par value (held by Federal Reserve banks subject to the order of the Governor of the Farm Credit Administration)		53,700.00				
Cash on hand and in banks		18,873.76		39,822.70		25,541.81
Cash on deposit with the Treasurer of the United States		98,120.29		3,187,648.81		257,022.44
Cash in U. S. Treasury—Dividend account		7,670.01		36,803.76		83,210.40
Cash in U. S. Treasury—Coupons matured prior to date of receivership						
Accounts receivable:						
Tax advances [1]	12,724.79		2,927.28		546.37	
Insurance advances [1]	269.62		215.86		105.15	
Other advances [1]	5,958.85	18,953.26	113.34	3,256.48	209.69	861.21
Purchase money mortgages and contracts:						
Purchase money first mortgages	83,590.25		[5] 891,159.54		76,841.80	
Purchase money second mortgages			[5] 30,765.26			
Real-estate sales contracts	466,889.88		91,200.00		1,367,133.05	
Real-estate notes receivable		550,480.13		1,013,124.80		1,443,974.85
Real estate owned outright		381,732.56		263,309.29		7,296,558.87
Sheriffs' certificates, judgments, etc		6,778.72		49,840.89		11,677.36
Furniture, fixtures, equipment, etc		2,911.05		1,381.39		15,589.40
Other assets		9.00		5,081.23		5,709.60
Total assets [2]		1,718,610.06		6,120,550.68		9,471,277.89
LIABILITIES						
Farm loan bonds:						
4¼ percent						
4½ percent			$2,363,500.00			
4¾ percent						

5 percent	$2,038,500.00		15,771,000.00		$18,845,700.00	
5½ percent					2,193,000.00	
Total	2,038,500.00		18,134,500.00		21,038,700.00	
Less liquidation dividend	[6] 611,550.00	$1,426,950.00	[7] 9,067,250.00	$9,067,250.00	[8] 8,836,254.00	$12,202,446.00
Interest on farm loan bonds:						
Unpaid interest maturing prior to date of receivership	100.00		18,102.50		552,587.50	
Unmatured interest accrued to date of receivership	42,787.50		262,103.55			
Total	42,887.50		280,206.05		552,587.50	
Less liquidation dividend	[6] 12,836.25	30,051.25	[7] 140,103.03	140,103.02	[8] 232,086.75	320,500.75
Dividends payable		7,670.01		36,803.76		83,210.40
Trust accounts:						
Unpaid interest maturing prior to date of receivership						
Other trust accounts	6,466.94	6,466.94	50,210.76	50,210.76	11,281.50	11,281.50
Other liabilities		49.82		1,318.27		146,355.06
Total liabilities [2]		1,471,188.02		9,295,685.81		12,763,793.71

[1] Tax, insurance, and other advances include only amounts paid on farms covered by mortgage loans not in process of foreclosure, purchase money mortgages, and real estate sales contracts. Such advances, made during the receivership in connection with any loan that is subsequently transferred to foreclosure, are charged to expense when such transfer is made. Advances made prior to the date of receivership in connection with loans now in foreclosure are included with "Other assets." Advances made prior to the date of receivership in connection with loans which have since become real estate or sheriffs' certificates, judgments, etc., are included in the book amounts of these items. All other advances on loans in foreclosure and on real estate owned are charged to expense.

[2] The figures for assets shown in the foregoing statement represent book amounts only and do not reflect the receiver's valuation on such assets. The foregoing statements do not include interest accrued on assets of the bank, and do not include interest accrued on the outstanding bond liability of the bank since date of receivership, which latter interest on Dec. 31, 1939, amounted to $83,081.04 for the Burlington Joint Stock Land Bank; $7,931,681.40 for the Chicago Joint Stock Land Bank; $332,955.04 for the Oregon-Washington Joint Stock Land Bank; $5,252,858.43 for the St. Louis Joint Stock Land Bank; and $6,429,659.25 for the Southern Minnesota Joint Stock Land Bank. Capital accounts are also omitted. Taxes accrued and not paid on real estate, sheriffs' certificates, and loans in process of foreclosure are not included as liabilities of the bank.

[3] 25-percent dividend declared payable as of July 31, 1938; 10-percent, as of Apr. 20, 1939; and 10-percent, as of Sept. 29, 1939.

[4] 30-percent dividend declared payable as of Sept. 29, 1934; 10-percent, as of Feb. 9, 1935; 10-percent, as of June 17, 1935; 10-percent, as of Sept. 11, 1935; 5-percent, as of Feb. 21, 1936; 5-percent, as of July 30, 1936; 2½-percent, as of Apr. 2, 1937; 2½-percent, as of July 1, 1938; 1½-percent, as of Apr. 25, 1939; 1¼-percent, as of Nov. 28, 1939; and ¼ of 1-percent, as of Nov. 28, 1939. This ¼ of 1-percent dividend represents a first dividend from unpledged funds to holders of claims based on bond obligations of the bank which have been allowed on or before Nov. 22, 1939.

[5] Purchase money first and second mortgages totaling $921,924.80 includes $9,714.01 which is in process of foreclosure.

[6] 20-percent dividend declared payable as of Apr. 30, 1938; and 10-percent, as of May 1, 1939.

[7] 20-percent dividend declared payable as of May 15, 1935; 10-percent, as of Jan. 25, 1936; 10-percent, as of Nov. 28, 1936; and 10-percent, as of Feb. 18, 1939.

[8] 20-percent dividend declared payable as of Jan. 31, 1935; 10-percent, as of Sept. 30, 1935; 6-percent, as of June 24, 1937; 4-percent, as of Aug. 3, 1938; and 2-percent, as of Nov. 27, 1939.

FEDERAL CREDIT UNIONS

TABLE 91.—*Number of Federal credit unions chartered, by States and by periods*

State	Oct. 1 through Dec. 31, 1934	1935	1936	1937	1938	1939	Total
Alabama			6	5	5	4	20
Arizona	1	3	2	8	2	1	17
Arkansas	1	2	8	3		1	15
California	1	46	85	41	36	39	248
Colorado		1	8	11	25	6	51
Connecticut	18	33	47	21	24	22	165
Delaware		1	4	5		1	11
District of Columbia		45	18	13	7	6	89
Florida	1	47	30	10	6	6	100
Georgia		12	9	10	2	4	37
Hawaii			19	41	22	9	91
Idaho		9	8	5	4	4	30
Illinois		13	16	29	31	8	97
Indiana		33	39	26	18	29	145
Iowa		1	2	1		1	5
Kansas	1	2	6	5	2	3	19
Kentucky		2	2		1	4	9
Louisiana	7	18	16	14	9	13	77
Maine	1	9	8	3	7	5	33
Maryland		3	9	8	4	3	27
Massachusetts	2	27	19	10	3	12	73
Michigan		6	36	12	3	9	66
Minnesota		2	3	5	3	1	14
Mississippi	1	6	2	4			13
Missouri	1	5	6	7	4	3	26
Montana		4	6	3	1	2	16
Nebraska	6	5	7	3	2	4	27
Nevada			3			1	4
New Hampshire			1	2	1	2	6
New Jersey	2	27	51	37	24	25	166
New Mexico		2	6	3			11
New York	6	104	111	73	74	91	459
North Carolina		4	21	3	2	1	31
North Dakota	4	10	12	6	2	3	37
Ohio		39	63	33	32	52	219
Oklahoma		6	9	8	7	7	37
Oregon		6	12	11	6	2	37
Pennsylvania	7	142	89	58	79	63	438
Rhode Island	1	2	7	3		2	15
South Carolina	1	6	9	8	5	4	33
South Dakota	4	9	1		2	2	18
Tennessee		15	21	18	7	2	63
Texas	2	62	59	44	38	48	253
Utah		15	5	2			22
Vermont	1		3			1	5
Virginia	9	15	17	11	4	9	65
Washington		1	21	11	7	3	43
West Virginia		20	7	2	4	10	43
Wisconsin			1				1
Wyoming		8	6	2		1	17
Total	78	828	956	638	515	529	3,544

FEDERAL CREDIT UNIONS

TABLE 92.—*Number of Federal credit unions in operation, number of members, share balance, loans outstanding to members, and total assets, June 30, 1939, by States*

State	Number in operation	Federal credit unions reporting				
		Number	Number of members	Share balance	Loans outstanding to members	Total assets
Alabama	19	19	3,744	$94,968	$91,700	$103,475
Arizona	15	15	2,106	107,906	109,619	124,151
Arkansas	12	12	1,561	38,614	37,620	44,057
California	208	205	63,683	3,667,526	3,399,235	4,040,921
Colorado	49	49	5,658	165,612	169,063	187,445
Connecticut	147	145	40,967	1,686,655	1,382,184	1,847,956
Delaware	11	11	2,192	60,222	54,861	65,949
District of Columbia	80	79	36,108	2,197,576	1,936,422	2,367,288
Florida	82	82	16,459	935,545	789,623	1,011,687
Georgia	34	34	9,222	394,403	360,547	436,266
Hawaii	86	85	22,420	1,358,064	1,317,688	1,524,762
Idaho	28	28	2,781	100,312	94,946	114,107
Illinois	84	82	26,992	1,215,910	1,149,547	1,339,820
Indiana	118	117	30,982	1,253,404	1,118,934	1,359,264
Iowa	4	4	573	18,274	14,827	19,686
Kansas	16	16	2,333	100,579	81,515	106,885
Kentucky	8	8	995	14,541	14,761	16,192
Louisiana	62	62	16,473	912,106	814,445	988,306
Maine	26	26	4,132	145,018	124,088	157,930
Maryland	25	25	7,118	187,383	147,887	209,375
Massachusetts	57	56	10,719	448,031	394,955	484,688
Michigan	52	52	13,175	702,839	529,568	744,825
Minnesota	14	13	2,280	75,027	69,673	79,958
Mississippi	12	11	2,087	90,059	87,367	98,664
Missouri	25	25	5,819	238,952	203,972	257,467
Montana	14	14	1,546	58,706	58,191	64,895
Nebraska	25	25	6,533	397,551	352,448	426,005
Nevada	3	3	224	7,437	6,803	8,300
New Hampshire	5	4	421	4,157	3,917	4,366
New Jersey	150	149	46,271	2,251,772	1,955,609	2,433,664
New Mexico	9	8	977	38,006	36,994	42,434
New York	382	378	94,014	4,504,982	4,011,593	4,891,419
North Carolina	17	17	2,823	128,273	114,746	139,741
North Dakota	31	31	3,286	120,174	126,353	137,589
Ohio	175	173	45,196	1,752,105	1,598,183	1,887,423
Oklahoma	33	32	4,571	197,447	192,213	215,476
Oregon	33	32	5,353	213,220	202,465	228,925
Pennsylvania	387	386	111,499	4,439,590	3,747,232	4,805,118
Rhode Island	12	12	2,638	87,208	62,447	92,804
South Carolina	28	27	5,411	166,831	149,840	180,674
South Dakota	15	15	2,978	148,171	133,671	162,919
Tennessee	52	51	10,115	319,118	283,363	345,407
Texas	209	205	44,345	2,611,121	2,489,413	2,859,127
Utah	19	19	3,515	125,901	110,229	137,409
Vermont	3	3	206	4,480	3,980	4,954
Virginia	50	50	8,081	259,751	218,085	280,798
Washington	39	39	9,167	334,894	299,068	360,006
West Virginia	27	27	5,174	166,882	158,928	183,803
Wisconsin						
Wyoming	14	13	1,488	53,157	52,763	59,484
Total	3,006	2,974	746,411	34,600,460	30,863,581	37,683,864

FEDERAL CREDIT UNIONS

TABLE 93.—*Number of Federal credit unions in operation, number of members, share balance, loans outstanding to members, and total assets, June 30, 1939, by type of membership*

Type of membership	Number in operation	Federal credit unions reporting				
		Number	Number of members	Share balance	Loans outstanding to members	Total assets
Cooperative	83	82	10,115	$367,980	$384,920	$435,279
Fraternal and professional	107	105	13,953	845,923	684,923	908,055
Religious	82	81	8,929	241,813	203,201	255,120
Labor unions	34	33	5,772	156,980	131,109	167,978
Amusements	8	8	3,456	343,369	257,943	371,145
Automotive products	32	32	9,432	294,517	252,391	321,517
Banking and insurance	40	40	9,077	427,002	348,375	459,213
Beverages	14	14	2,925	68,240	59,745	75,350
Chemicals and explosives	47	47	16,468	693,172	547,849	747,089
Lumber	19	19	4,752	106,152	99,287	113,467
Construction and materials (other)	29	29	7,456	265,550	215,554	283,315
Colleges	28	27	3,056	137,622	115,679	144,719
Schools	215	210	29,636	1,745,936	1,528,361	1,955,919
Electric products	93	93	34,362	1,443,897	1,218,290	1,543,265
Bakery, grocery, and produce	52	52	10,420	520,387	457,712	561,019
Dairy products	55	55	8,811	452,482	408,699	490,780
Meat packing	40	40	7,553	325,044	315,541	358,041
Food products (other)	39	39	10,512	497,915	423,462	534,340
Furniture	14	14	2,006	54,924	49,701	59,865
Glass	19	19	7,614	308,080	302,452	334,046
Federal employees	289	285	79,736	4,365,971	4,086,478	4,813,427
Local government employees	118	118	37,356	2,804,035	2,789,942	3,092,002
State employees	47	47	13,448	603,427	551,994	652,186
Hardware	29	29	8,493	327,267	249,797	346,518
Hotels and restaurants	54	52	8,715	207,922	159,910	222,847
Laundries and cleaners	29	29	3,768	132,224	90,607	139,505
Leather	10	10	2,037	58,855	51,681	65,131
Machine manufacturers	60	59	19,416	895,438	682,674	950,269
Aluminum	13	13	4,514	180,830	139,725	194,117
Iron and steel	99	98	39,425	1,548,236	1,222,612	1,653,938
Metals (other)	45	44	15,938	482,294	440,369	525,212
Paper	42	41	9,258	308,078	280,031	335,258
Petroleum	216	215	64,084	3,681,818	3,513,572	4,079,130
Newspapers	50	49	8,537	534,459	463,264	580,427
Printing and publishing (other than newspapers)	27	27	4,961	242,817	203,293	257,126
Heat, light, and power	97	97	26,134	1,309,119	1,208,457	1,429,469
Telegraph	14	14	2,494	105,555	86,774	112,936
Telephone	46	46	15,182	840,036	814,329	910,352
Rubber	15	15	4,012	117,408	123,612	133,399
Stores	174	172	56,542	2,515,928	1,956,286	2,675,040
Textiles	80	78	20,135	471,961	422,683	514,052
Tobacco products	1	1	898	22,560	19,719	25,028
Aviation	17	16	10,577	558,801	508,631	605,912
Bus and truck	28	27	5,656	182,587	153,613	199,395
Railroads	148	147	32,108	1,104,212	1,097,565	1,209,631
Transportation (other)	59	58	20,937	737,493	733,755	796,963
Miscellaneous occupational	57	57	12,025	442,997	370,532	479,815
Rural community	71	70	9,803	376,678	309,430	405,259
Urban community	21	21	3,917	144,469	127,052	159,998
Total	3,006	2,974	746,411	34,600,460	30,863,581	37,683,864

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REPORT OF THE ADMINISTRATOR OF THE FARM SECURITY ADMINISTRATION

1939

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LETTER OF TRANSMITTAL

UNITED STATES DEPARTMENT OF AGRICULTURE
FARM SECURITY ADMINISTRATION

WASHINGTON, D. C., *October 1, 1939.*

HON. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY:

I transmit herewith a report of the work of the Farm Security Administration for the fiscal year ended June 30, 1939.

Sincerely yours,

WILL W. ALEXANDER,
Administrator.

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REPORT OF THE ADMINISTRATOR OF THE FARM SECURITY ADMINISTRATION 1939

INTRODUCTION

The job of the Department of Agriculture is to help farmers meet problems they cannot handle alone. As new problems have arisen with the growth of American agriculture, new agencies have been set up in the Department to meet them.

When, as a result of the depression, more than a million farm families were put on the relief rolls, the very poverty and insecurity of nearly one-third of America's farmers created a new and urgent national problem. To deal with this problem, the Farm Security Administration was created.

The purpose of the Administration is to help needy farm families to become permanently self-supporting. Since 1935 it has extended financial aid to more than 1,231,000 farm families, many of which had once been on relief. It is now helping more than 589,000 families to plan and finance their farming operations.

The help offered by the Administration takes many different forms, because it is intended to overcome a wide variety of difficulties. A family may be in trouble because of poor land, bad management, drought, ill-health, an overload of debt, ignorance of sound farming methods, inability to secure credit, or many other handicaps. The Administration helps each family to find the answer to its individual problems; and if necessary it loans the family the money needed to solve them.

The work of the Farm Security Administration is carried on under three general divisions, which represent the immediate, the long-term, and the experimental programs of the agency. They are as follows:

1. Rehabilitation: Needy farm families, which cannot get adequate credit anywhere else, are provided with small loans to enable

them to make a living from the land. Every loan is accompanied by advice in planning a sound system of farm management. Rehabilitation borrowers also are helped to negotiate voluntary debt adjustments with their creditors; and to form cooperatives to provide necessary equipment and services, such as group medical care, which no single family could afford alone. In cases of extreme distress, usually in drought and flood areas, small grants are made to tide farmers over until they can make a crop.

2. Tenant purchase program: A limited number of tenants, sharecroppers, and farm laborers are provided with loans to enable them to buy farms of their own. This program, authorized by the Bankhead-Jones Farm Tenant Act, is intended to check the alarming increase in farm tenancy, and to preserve the traditional American institution of the family-sized farm.

3. Homesteads, projects: The Farm Security Administration is completing and managing 161 projects of many different types started by the Resettlement Administration and other earlier agencies. This is primarily an experimental program, intended to develop better methods of economic organization in agriculture.

Developments in these three programs during the year are described in the following pages.

REHABILITATION

The rehabilitation program is the biggest job of the Farm Security Administration and reaches more people than any other of its activities. It grew out of the early efforts of the Federal Government and the State emergency relief administrations to help farm families to help themselves, rather than to leave them dependent indefinitely on direct relief.

Today it is carried on by Farm Security Administration county supervisors, operating in nearly all of the Nation's agricultural counties. These men are practical, experienced dirt farmers, most of whom have been trained in the agricultural colleges of their own States.

A needy farm family is eligible for help under the rehabilitation program only when (1) it cannot get adequate financing from any other source, (2) it is recommended as honest and hard working by substantial citizens in its own county, and (3) it owns or is able to rent a farm which can produce a living.

PLANNING BETTER FARM AND HOME MANAGEMENT

When such a family comes to a Farm Security Administration county supervisor for help, the first step is to find the cause of its troubles, and the second is to work out a farm- and home-management

plan that will overcome these difficulties and enable the family to get back on its feet.

In making such a plan, the farmer sits down with the county supervisor and goes over his situation in detail—how big his farm is; how fertile; how much equipment he has; how much livestock; how much debt; what cash crops and feed crops he has planted in the past; how many acres he has in garden and food crops. These facts are checked by visits to the farm.

Then the family and the supervisor decide what changes can be made to increase the family's income and get it back on a self-supporting basis.

The farmer's wife and an Administration home management specialist usually work out a similar plan for the home, planning better and thriftier ways of providing a good diet and decent clothes and closer supervision over the expenditure of the family income.

Whenever possible, the plan for a tenant family calls for a long-term written lease to guarantee stability. It also calls for enough equipment to get the most out of that farm; the growing of as much food and feed as possible at home; a variety of cash crops; and contouring, rotations, and other soil-conserving practices. Often the plan provides for a variety of small improvements to round out a program of sound farming—new shelves in the pantry to accommodate the increase in canned foods, a trench silo in which to store feed, a pressure cooker, or a new stove, the planting of an orchard, or repairs to the home.

The farmer and his wife keep a record book, in which they enter from week to week their income, expenditures, and additions to their wealth not strictly accountable in cash, such as storage of canned and dried foods.

These record books can be checked with the farm plan throughout the year. A well-kept record book becomes a valuable auxiliary to the farm plan, indicating where more effort is needed and showing evidence of progress. At the end of the year, it becomes a basis on which the next year's farming can be planned. Gradually, in this way, the planning becomes a continuous process, which can be carried on profitably by the farmer and his wife long after they are back on their feet and beyond the concern of the Administration.

LEARNING NEW METHODS

Periodically—every few weeks or as often as he can get around—the county supervisor visits the family to check up on its progress and offer any help he can.

Often, when several farmers in a neighborhood are learning the same things, group meetings help a number of neighbors to learn

a new method together. Demonstrations of how to construct and fill a trench silo, how to can beef, how to make a mattress, how to plan a balanced diet, and so on, have been held throughout the country for Farm Security borrowers.

This common-sense education and planning is the very heart of the rehabilitation program. Most of these borrowers had failed in the past simply because they did not know how to farm efficiently. Guidance in good farming methods is the best guarantee that they will not fail again; and at the same time it is the best protection for the Government's investment in these families.

FINANCING BETTER FARMING

This investment, usually represented by a $300 to $400 rehabilitation loan, is made to enable the farmer to carry out his improved farm plans.

The loan is just large enough for the purchase of the things that the farmer needs to make a living—a horse or a mule, a plow, seed, fertilizer, a pressure cooker for canning, a few pigs, and chickens. Sometimes it includes a small sum for food and livestock feed to carry the family until the first harvest.

The size of these loans naturally varies with the type of agriculture in each area. During the past year loans to standard rehabilitation borrowers averaged $397 each.

The loans draw 5-percent interest. Amounts loaned for things used up in 1 year, such as feed and fertilizer, are due at the end of the harvest season. Amounts loaned for equipment, work stock, and other durable goods are paid back over a period of 5 to 10 years.

EMERGENCY LOANS AND GRANTS

In areas stricken by drought, flood, or hurricane, and in other emergencies, farmers often need small loans quickly to save their crops or provide food for their families and feed for their livestock. In such cases, the Administration provides limited sums immediately, without taking time to draw up a farm- and home-management plan. Later on, emergency borrowers may apply for standard loans, and farm-management plans are worked out to provide for the repayment of the entire indebtedness.

During the past year such loans were limited, generally, to drought and flood areas where it was not possible to make standard rehabilitation loans. Original emergency loans were made in the amount of $1,448,938; supplemental loans totaled $1,392,321.

There is another group of destitute farmers who could not wisely be given rehabilitation loans, even if money were available. Thou-

sands of families living in drought areas have not received loans, because their land did not contain enough subsoil moisture to justify planting a crop. A large number of families have migrated from the dust bowl area to the Northwest and Pacific Coast States. Many of these are earning a scanty hand-to-mouth living as farm laborers, while others have settled on acreages too small or too barren to support a family. It obviously would be both a waste of the Government's money and an injustice to the borrower to attempt rehabilitation on such submarginal land where failure is virtually certain.

Under such circumstances, therefore, the Administration has temporarily made subsistence grants, averaging about $20 per month per family, rather than rehabilitation loans. During the past year the total cash grant disbursement to individual families amounted to about $22,758,444.

Every effort is made to reduce the grant load by helping these families to find means of producing an income. The average family receives grants only for about 4 months. There is little prospect, however, that the grant program can be entirely eliminated within the near future.

Grants have also been used occasionally, outside of the emergency areas, to supplement standard rehabilitation loans. Sometimes, in working out a sound farm plan for a needy family, the supervisor finds that the family needs more food and clothing than can be financed with any reasonable expectation of repayment after making provision for operation of the farm.

That kind of a case leaves three alternatives: (1) To refuse the request for the loan and let the applicant fall back on direct relief of one kind or another; (2) to make the loan, realizing that some of it cannot be repaid; or (3) to help the farmer get a new start by means of a loan for the necessary equipment, plus a small grant for food supplies, livestock feed, and other emergency subsistence needs.

Under such circumstances, the Administration has chosen the third course, believing that in the long run it is cheaper for the Government and much better for the borrower.

TENURE IMPROVEMENT

Many of the farmers who came to the Administration for aid were cultivating farms too small or too poor to support a family. These farmers were helped to find and lease more or better land. About one-sixth of all borrowers have been helped to find bigger or better farms, as a necessary step in their rehabilitation.

Once it is located on a good farm, the family is helped to stay there for a long period, so it can save the cost of frequent moving, and build up the land and farm buildings from year to year.

During the past year, the Administration has insisted that tenants receiving aid have written leases, rather than vague oral agreements with the landlord. A carefully prepared flexible lease form is offered as a basis for agreement.

Experience has shown that a written lease is a valuable protection for both landlord and tenant. If the farmer and landowner merely make an oral agreement, many disagreements are likely to arise later over such questions as the responsibility for replacing a corncrib blown over in a storm, or rescreening the house, or liming the land. Most disputes and much unnecessary moving arise from misunderstandings over just such points.

A written lease also eliminates some of the fear of having to move which, by discouraging long-term planning, is a greater evil than moving itself. It gets over this difficulty by providing that the lease shall continue in effect for several years, or shall not be terminated by either party without written notice to the other several months in advance.

The flexible lease also encourages the tenant to make lasting improvements on the farm, through an optional clause providing that if he is required to move before he has obtained full use of a permanent improvement he shall be paid for its unexhausted value on a basis set forth in the lease.

Approximately 7 out of every 10 Farm Security borrowers are tenants. Of these tenants, one-sixth have been helped to advance from sharecropper to tenant status under the rehabilitation program. More than four-fifths have obtained written leases, and one-fourth have written leases which run for more than 1 year, or are automatically renewable. In most areas the great majority had formerly operated under oral agreements.

FARM-DEBT ADJUSTMENT

Many farmers needing help from the Administration are already loaded with debt beyond their ability to pay. Consequently, voluntary adjustment of these debts is an important step in their rehabilitation.

Through friendly negotiation, 101,133 farmers have reached agreements with their creditors for scaling down debts totaling $328,571,273. Adjustments have totaled $79,179,031, or about 25 percent. In many instances in which the total debt was not reduced, terms and interest rates have been revised.

Such adjustments have helped many farm families to escape foreclosure and have enabled creditors to collect something on what would otherwise have been a hopelessly bad debt. As a direct result of such adjustments, farmers have paid more than $4,650,000 in back taxes to local governmental agencies.

Farm-debt negotiations are carried on by voluntary committees of local citizens, appointed by the Farm Security Administration. The Administration merely acted as an intermediary in organizing the local committee, and in bringing farmer and creditor together in an atmosphere of mutual friendliness.

This service has not been confined to rehabilitation borrowers, but has aided many farmers who required no further help from the Administration.

GROUP-DEBT ADJUSTMENT

A group-debt-adjustment program also has been set up to help farm community organizations, such as drainage or irrigation districts, which are overburdened with debt. This work has required more active participation by State and regional farm-debt-adjustment representatives than in individual debt cases, because the technical and legal difficulties in adjusting a bond structure are so much greater than those met in adjusting personal debts.

During the period from September 1, 1935, to June 30, 1939, 80 group cases were adjusted, in which the total indebtedness originally was $16,709,221. These debts were reduced to $5,218,949, a reduction of $11,490,272. These adjustments directly benefited 10,996 farmers.

During the past year, 30 group-debt-adjustment cases were settled, with a reduction of $6,256,829 from a prior debt of $8,231,788. These adjustments directly benefited 3,736 farmers.

The success of the program has been largely due to the cooperation of such creditors as banks, insurance companies, and professional men and merchants, who realize that their own interests, as well as the farmers', are best served by sensible, voluntary adjustment of debts.

COMMUNITY SERVICES

The community-service and cooperative-loan program is a simple adaptation of the rehabilitation loan to a group or a community. Usually, it has been used to meet a specific need which has become obvious in a community or among a neighborhood group of low-income farmers. In some areas, however, it is developing toward community planning, with loans based upon a broad survey of needs, similar to that in the farm and home plans of individuals.

When several rehabilitation borrowers living in one community need a piece of heavy machinery, or a purebred sire, or other service which no one of them can afford alone, the Administration often makes them a special community-service loan to finance the purchase.

The importance of this program is emphasized by recent developments in American agriculture. The increased use of modern machin-

ery, good livestock, and expert management is resulting in the growth of huge "outdoor food factories," often owned by corporations, which can produce more efficiently than small farmers using hand labor or obsolete tools and methods. In some areas the small farmers are losing out, for lack of equipment which no one small farm can support. But when a group of small farmers get together to buy and use modern machinery and purebred sires, they usually are able to compete on more even terms with the large-scale commercial farms.

The purchase of such equipment for community use is generally arranged in one of two ways—whichever the community prefers. Either the farmers form an association to buy and handle the new service, borrowing individually to contribute to the purchase price; or one farmer can borrow the money, and all the others sign an agreement to use the service at a stipulated price, which will enable the master borrower to repay the loan.

During the past year, 72 different types of services have been established through such community and cooperative loans. Of the 4,333 services established during the year, 32 percent were for sire services, 43.8 percent were for machinery and equipment services, 20 percent were for miscellaneous services, such as home equipment, storage facilities, sirup mills, grist mills, hatcheries, etc., 2.4 percent were for participation loans in grain-marketing associations, and 1.8 percent were for the establishment of medical services. These loans involved approximately $3,054,000 and are serving 107,059 families. In addition, 1,134 services benefiting 5,700 families, were established without the use of Farm Security funds, through advice and help of Administration employees.

Three developments of the year are being watched with particular interest.

One has been strictly technical. The increasing demand for livestock sire services has led to the establishment of a number of breeding cooperatives using methods of artificial insemination. These may prove important as a means of enabling owners of small herds to improve their livestock through use of the best available sires in a wide area. While the present units provide only bull services and have been confined largely to densely populated dairy areas, a number may be set up eventually for other kinds of livestock.

Another development has extended cooperation beyond the confines of a neighborhood, by setting up livestock replacement services on a State-wide basis. Experience has shown that rehabilitation borrowers, operating with little capital, may be bankrupted if the death of a work animal requires a heavy cash outlay not provided for in the year's farm plan. During the past 2 years, a State-wide livestock replacement insurance service has been operating in Mississippi under Administration sponsorship. This service insures work stock of

Administration borrowers at an appraised value, with a premium charge on this valuation varying from 4 to 5 percent. The indemnity paid for any disability or death loss ranges from 75 to 85 percent of the appraised valuation. Similar programs were started in Louisiana and Arkansas during the year.

A third development has been toward more complete organization of cooperative services to meet the heavy equipment needs of an entire locality. For example, in Box Elder County, Utah, 205 such cooperatives have been established to serve a large share of all farmers in the county. These developments, which have occurred rather spontaneously, are being watched with special care. They may point the way toward a better approach to full community effort in the future.

MEDICAL CARE FOR NEEDY FARM FAMILIES

Many farmers had failed and been forced to seek help from the Administration, simply because they or their families were in bad health. Moreover, it was plain that these people had no chance to get back on their feet until they were well enough to do a good day's work.

An investigation of a number of rehabilitation borrowers who failed to meet their loan payments on schedule disclosed that nearly half of them were suffering from malaria, hernia, abscessed teeth, or some other serious illness. Often they had never been able to afford proper medical care, and in other cases they defaulted on their loan payments because they had used what little money they had to meet urgent medical bills.

Simply as a matter of good business, in order to protect its investment in rehabilitation borrowers, the Administration was forced to start a program of medical care for needy farm families, in cooperation with local medical societies.

Group-medical care plans vary widely, to meet preferences of doctors and borrower families in each locality. In every case a general scheme of operations is worked out in cooperation with the State medical association and is embodied in a written agreement. Details of operation are then worked out with the local physicians in each county.

The agreements with the county societies recognize the three basic principles of the medical program: (1) The fees are based on the ability of the rehabilitation families to pay; (2) there is free choice of participating physicians; and (3) funds are set aside in the hands of a bonded trustee at the beginning of the operating period.

Under the plan in most general use, each cooperating family in the county pays in at the beginning of the year a certain amount, varying with the size of the family; usually $2 per month for a

family of two, with small additional sums for each child. These funds are turned over to a trustee, who sets aside a twelfth of the total for paying bills each month.

The families choose any doctor they wish from among local cooperating physicians and call on him when they need medical attention. At the end of the month, each doctor turns in his bill for services rendered. All bills are examined by a committee of the local medical society to see that they are fair and then are turned over to the trustee. If that month's allotment of funds is more than enough to pay all the bills, they are paid and the balance is carried forward to the next month; if not, each bill is reduced proportionately, and each doctor receives his pro rata share of the allotment. Money carried forward from months in which there is an excess is generally used to make up deficiencies in other months.

The medical benefits covered in the plan usually include (1) ordinary medical care, including examination, diagnosis, and treatment in the home or in the office of the physician; (2) emergency surgery necessary to save the life or limb of the patient, as determined by the physician in charge; (3) emergency hospitalization recommended by the attending physician; (4) obstetrics, including prenatal, delivery, and postnatal care; (5) ordinary drugs dispensed or prescribed by attending physician; and (6) dentistry prescribed by the attending physician and believed necessary to relieve acute systemic diseases or to relieve pain. Where drug, hospital, and dental services are included, certain portions of the trust fund usually are set aside to pay for them in advance.

At first there was some fear that this plan would not work, on the theory that if a family could call a doctor at any time without additional cost, people would abuse the privilege and call a doctor every time they cut a finger. In practice, however, abuses have been rare, and families taking part have asked only normal and necessary medical attention.

The plan has several advantages. Since it has paid in advance, a family has no reason to wait until an illness becomes critical to call a doctor; the plan encourages preventive care. No reluctance because of a previous unpaid bill stops the family from calling the doctor when needed. The plan also serves as a sort of voluntary insurance against the bankruptcy which might result from serious or emergency illness in any one family. Finally, the doctors receive prompt, if not always full pay, for services to families which in the past have often been able to pay little, if anything.

Farm Security borrowers desiring to take part in such plans, who are unable to raise the money at the first of the year, are loaned the necessary funds. The Administration has found that such loans

benefit it almost as much as the farmer, since a family in good health is a much better credit risk—not only for the medical loan, but for its ordinary rehabilitation loan as well.

As of June 30, county or district plans for medical care were operating in 23 counties in Alabama, 68 in Arkansas, 2 in Colorado, 5 in Florida, 108 in Georgia, 5 in Indiana, 2 in Idaho, 5 in Iowa, 25 in Kansas, 7 in Louisiana, 41 in Mississippi, 12 in Missouri, 1 in New Jersey, 7 in New Mexico, 10 in North Carolina, 11 in Ohio, 12 in Oklahoma, 17 in South Carolina, 69 in South Dakota, 7 in Tennessee, 18 in Texas, 1 in Utah, and 8 in Virginia. The swift expansion of the program during the last 2 years is indicated by the increase in the number of county plans operating in Georgia, where only 5 counties participated in 1937–38, whereas 108 counties took part during the past fiscal year.

Agreements with the State medical associations, prior to approaching county medical societies, have been reached in Wisconsin, Wyoming, Kentucky, Pennsylvania, New Hampshire, and West Virginia.

WATER FACILITIES FOR DROUGHT AREAS

Under the water-facilities program three agencies within the Department have pooled their skill and resources to help certain farm communities better themselves.

The most important feature of this program is that its machinery—plans to guide community effort toward better use of land, loans to help individuals take fuller advantage of water resources, and close cooperation among Federal agencies—has been set up so that experience in its administration will serve as a guide to future efforts to meet similar problems in other areas.

These elements in the program make it of especial interest, despite the small number of people so far involved. At present, the program is an important aid in the rehabilitation of more than 300 families in the Western States.

In many cases successful rehabilitation of needy farm families, in an area of low rainfall, depends on the better use of land and water resources.

Consequently, under specific authorization by Congress, the Bureau of Agricultural Economics, the Soil Conservation Service, and the Farm Security Administration have aided in the development of a small water-facilities program for the benefit of low-income farm families in the arid and semi-arid areas of the 17 Western States.

The program provides Federal assistance to establish and maintain such water facilities as ponds, reservoirs, wells, pump installations, spring developments, water-storage tanks, and facilities for recharging underground reservoirs. It is expected that more than

90 percent of the water facilities installed under this program will cost less than $2,000 each.

The part played by the Administration in this cooperative program is to provide farm- and home-management plans, and to make and collect loans. Loans are made only to low-income farm owners and tenants, or to groups of farmers who are eligible for loans under the community and cooperative services program. Water-facility loans to individuals are frequently supplemented by rehabilitation loans to help the family adapt its farming to its new opportunity, as for instance by purchase of livestock for increased pasture.

Interest is charged on the loans at 3-percent. The repayment period may extend for the life of the structure, but in no instance for more than 20 years.

During the past year 330 water-facilities loans, involving a total of approximately $184,315, were made to individual farmers.

Plans for improvement and extension of the program were given serious study during the year.

PROGRESS UNDER THE REHABILITATION PROGRAM

A survey at the end of the 1938 crop year indicated that throughout the country, except in areas suffering from drought and other natural catastrophes, standard rehabilitation borrowers have increased their home food production, working equipment, living standards, and total net worth.

A total of 232,947 families, including 1,186,302 persons, were studied. The facts brought to light graphically illustrate some of the methods and results of the program.

Many of the families who applied for loans were cultivating acreages too small to support a sound farm enterprise. These families were helped to find additional land or larger farms. The average number of acres in cultivation on farms operated by borrowers at the time of acceptance on the rehabilitation program was 70; at the close of the 1938 crop year it was 131.

An indication of the change in operating methods and equipment which accompanies acceptance on the rehabilitation program is indicated by the experience of borrowers who had been on the program only 1 year. These 63,000 borrowers owned only 77,710 work animals at the time they received loans, but by the end of the 1938 crop year they owned 137,710 work animals, an average increase of nearly 1 per farm, or more than 75 percent.

The average number of subsistence cattle owned before these borrowers began to participate in the program was 2.2; at the end of 1938 the average was 3.9. Moreover, the borrowers doubled their ownership of poultry and hogs.

To support this increase in livestock production, first-year borrowers increased their acreages in feed and forage from 1,862,740 to 2,705,520.

Better farm- and home-management had produced a marked improvement in the standard of living of the 233,000 borrowers studied. The average production of milk per family increased from 99 to 465 gallons per year. The average amount of meat produced for home consumption rose from 85 to 377 pounds annually. Production of eggs for home consumption was almost four times as large.

Families participating in the program also planted gardens to supply the home kitchens. Between peak labor periods in the fields, they canned and preserved enough foods to carry them through the winter. After joining the program, the quantity of fruits and vegetables canned and stored increased from 51 to 221 quarts per year for each family.

The rise in the standard of living went hand in hand with an increase in the net worth of borrowers. The decrease in cash outlay for food resulted in larger expenditures for more lasting improvements. The net worth of these 233,000 families—that is, the value of furniture, clothing, supplies, livestock, and equipment, minus all debts—increased $269 per family since they received loans. This meant an addition of $62,773,173 to the wealth of their communities by this group alone.

Between December 31, 1937, and December 31, 1938, these 233,000 families increased their average net worth from $833 to $975, an increase of $142, or 17 percent.

The results of the rehabilitation program cannot be measured in dollars alone. For instance, 186,619 children in this group of families increased their school attendance as a direct result of the rehabilitation program.

Before receiving Administration loans, only 37 percent of the first-year borrowers had written leases. At the end of 1938, 39,216 or 85 percent of first-year tenant clients had them. In other words, 48 percent of the first-year borrowers changed from verbal to written leases. Moreover, during the same period 19 percent of these farmers obtained longer term leases than before. In 1937 about 3,400 of the first-year borrowers had advanced from sharecropper to tenant status; 18,161 did so in 1938. Altogether, 26,800 borrowers advanced from sharecropper to tenant status between December 31, 1937, and December 31, 1938.

COLLECTIONS ON REHABILITATION LOANS

The progress of these borrowers is reflected in collections during the past year.

At the end of the fiscal year the number of Administration rehabilitation active loan cases totaled 589,046. The total amount outstanding on loans to individuals was $280,837,769, of which $44,183,032 was loaned from funds of the State rehabilitation corporations.

Although much of the money advanced had not yet fallen due, the Administration had collected $83,305,353 on the principal of loans from emergency funds, of which $33,399,553 was collected during the last year. In addition, $20,217,872 has been collected on principal of loans from funds of State rehabilitation corporations.

The percentage of Administration loan maturities collected ranged from 50.5 percent in the drought States of Kansas, Nebraska, North Dakota, and South Dakota, to 82.8 percent in Michigan, Minnesota, and Wisconsin. Approximately 99,000 families had paid back their loans in full by July 1, 1939. Many borrowers not only had paid all their installments on time but also had made substantial payments in advance. In Maine, for example, 24.3 percent of the unmatured loans had been paid in advance.

The amount collected has been influenced not only by agricultural conditions, but also by the policies of the Administration, which has tried to make rehabilitation the primary objective. First consideration has been given to the welfare of the borrower: collections have not been demanded on the due date, when forced payment would have destroyed the farmer's chance to get back on his feet.

Despite the fact that none of the borrowers was considered a safe commercial risk, it has been conservatively estimated that approximately 80 percent of the money loaned will be eventually returned to the Federal Treasury, except in those areas which have suffered from prolonged drought. Total losses will be a very small fraction of the sum it would have cost to support these families on relief.

TENANT-PURCHASE PROGRAM

The tenant-purchase program, authorized by Congress in 1937, deals directly with the problem of farm tenure, and indirectly with the problems of farm citizenship. Its immediate goal is ownership of family-sized farms by their operators. Its indirect result is to promote good citizenship by giving thousands of deserving families "a stake in the country"—a new feeling of responsibility, self-respect, security, and concern with the affairs of their communities.

This program might well be regarded as rehabilitation carried one step further. It encourages rehabilitation borrowers to make good, by holding out the possibility of farm ownership as an ultimate goal. Moreover, the methods which were developed for the rehabilitation program—notably the system of sound planning and record keeping—have been carried over to the tenant-purchase program with notable success.

The chief differences between the tenant-purchase program and rehabilitation are: (1) The idea of making loans for equipment is extended to include the farm itself, as the most important item of equipment needed for security; (2) because the loans are larger, the qualifications for borrowers are more exacting; and (3) since the tenant-purchase borrower has permanent possession of his farm, he can plan long-range improvements which are not possible for the renter who may have to move within a year or two.

DISTRIBUTION OF FUNDS

As authorized by the Bankhead-Jones Farm Tenant Act, $25,000,000 was appropriated for the tenant-purchase loan program during the fiscal year 1939. Of this amount, $1,250,000, or 5 percent, was allocated for administrative expenses, and the remaining $23,750,000 was apportioned among the States and Territories on the basis of farm population and prevalence of tenancy. (Including unencumbered balances of the previous year, the total amount allotted for loans was $24,320,000.)

These loans were made in 732 counties designated by the Secretary of Agriculture on the recommendation of State farm security advisory committees. In selecting counties, these committees were guided by such factors as farm population, prevalence of tenancy, and availability of satisfactory farms at reasonable prices. The counties designated are relatively more numerous in the Southern States, where the tenancy problem is most acute.

The widespread demand for tenant-purchase loans is indicated by the fact that 109,912 applications were received during the year. This number, together with 36,178 applications held over from the previous year, made 146,090 applications on hand. This meant an average of 34 potential borrowers for each loan made during the year. In the 14 Southern States, the number of Negro applicants was five times that of last year. Out of the total of 92,850 applications in these States, 27 percent, or 25,244, were from Negroes.

SELECTION OF BORROWERS

In accordance with the provisions of the act, applicants for loans were approved by county committees consisting of three local farmers. These committees took into account the applicant's character, reputation for paying debts, ability to operate a farm, and inability to obtain adequate credit from any other source. The general character, ability, and experience of tenant-purchase borrowers are high and will go far toward assuring their success.

Of 4,340 loans approved during the year, 722 were made to Negro farmers in 14 Southern States. Loans to Negroes in those States amounted to only 23 percent of the total number made, however,

while the number of Negro tenant farmers was 35 percent of the total number of tenant farmers.

Each farm approved for purchase by a selected family was appraised and certified by the county committee. Technical appraisal reports by trained Government appraisers were available to county committees, and nearly all of the farms were purchased within the appraised values. A special study of the methods used in appraising farms for the tenant-purchase program was made and certain modifications were decided on. In the future, a determination of the earning capacity of the farm will replace the older method of valuing land and buildings on the basis of prevailing market values. In other words, the prospective earning power must be sufficient to support the investment.

Each loan was supported by a farm- and home-management plan developed by the borrower with the assistance of the local farm- and home-management supervisors. In accordance with the terms of the act, each loan is secured by a first mortgage on the property including land and improvements. Insurance representing the full replacement value is carried on all buildings.

REPAYMENT BASED ON EARNINGS

Under the terms of the Bankhead-Jones Farm Tenant Act borrowers may repay their loans under a variable payment plan, which means that in years of above-normal income the borrower will be expected to pay more, and in years of below-normal income he will pay less than the annual installment under the fixed repayment plan, which is amortized at 4.326 percent per annum.

This is the first recognition in national farm-loan legislation of the variability of farm income, because of factors beyond the farmers' control. The variable payment plan is based on the borrower's ability to pay, and the payment due in any given year is determined by the net income for that year, as indicated by accurately kept farm accounts. The response to the variable payment plan has been good, and it is expected that a majority of borrowers will take advantage of the protection it provides.

PROGRESS UNDER THE TENANT-PURCHASE PROGRAM

A total of $33,339,684 in loans (which includes State rural rehabilitation corporation trust funds amounting to $362,101) was approved in the first 2 years of the program. Because many borrowers did not take possession of their farms until late in the 1938 crop year, however, the payments due as of January 1, 1939, amounted to only $99,853. As compared with these maturities, $150,314 had been paid as of July 25, 1939.

Total repayments, therefore, were 152 percent of maturities. In a few cases maturities were not liquidated in full, but payments on actual maturities amounted to $92,050, or 92 percent of the total amount due.

Each farm bought with a tenant purchase loan is visited by an Administration construction engineer, who, together with the county and home supervisors, advises the borrower on plans for the repairs and improvements necessary for decent living and successful operation of the farm. It has been necessary to construct new dwellings or to repair old dwellings on 4,139 farms, or 96 percent of those bought during the year. The standards of housing represent the minimum needs for decent shelter, reasonable comfort, and sanitation.

Tenant-purchase loans made during the year included money for building 1,610 new dwellings. This number, plus the 446 new dwellings constructed during the previous year, makes 2,056 houses built under the tenant-purchase program. Most of these new dwellings were built in the South, where it was often necessary to purchase land that did not have suitable buildings.

The cost of the new dwellings averaged only $1,313. This low figure resulted from continuous efforts of the engineering staff to simplify and standardize design, and to cut costs to an absolute minimum.

Repairs on dwellings were made on 2,556 tenant-purchase farms during the year. The average cost of repairs to dwellings, barns, and outbuildings was $405.

Some loans also included money for the construction of barns, chicken houses, smokehouses, sanitary outdoor toilets, and other buildings necessary for the satisfactory operation of the farms. Such buildings were constructed on 4,146 farms at a cost averaging $487 per farm.

Funds were included in loans, when needed, to provide for land improvements such as terracing, liming, drainage, and fencing. Although the farms purchased usually have been going concerns, land improvements sometimes have been advisable in order to maintain soil fertility and protect the Government's investment. The loans provided for such improvements on 3,147 farms at an average cost of $186.

HOMESTEADS PROJECTS

Homestead projects were started by the Resettlement Administration, the Division of Subsistence Homesteads of the Department of the Interior, and other earlier agencies, to demonstrate sound principles of farm and community management, and to experiment with new developments along these lines.

Since 16 of these projects were turned over to the Farm Security Administration, they have been administered in strict accordance with the original aims. The projects are scattered through the country in nearly all States, crop areas, and climates. Some of them have been set up with scattered individual farms; some with a single large cooperative farm operated by the residents as a group; others with various combinations of these two plans. A few have industrial enterprises to supplement farm income. In some cases the houses are scattered on individual tracts, while in others they are clustered together.

Residents for the projects, now totaling about 14,000 families, have been selected from among tenants in nearby areas, from former residents on submarginal lands recently taken out of cultivation, from groups left stranded in worn-out mining and lumbering districts, and occasionally from low-income city workers with farm experience.

Every effort has been made to get a wide variety of people, economic organization, and operating methods, in order to obtain the broadest possible experience in different types of agricultural development. It is still too early to state the results of these experiments, but studies of the projects now being made by the Bureau of Agricultural Economics and other agencies should provide valuable guideposts for the future course of American agriculture.

There were few major changes in the farming and subsistence-homesteads projects during the year; their progress was, in general, satisfactory.

CAMPS FOR MIGRANT FARM WORKERS

Important developments were made, however, in another type of project—the camps set up for the use of seasonal, migratory agricultural laborers. The need for such camps has increased rapidly, and the camp program was expanded to meet it.

Two current trends in American agriculture, mechanization and rural unemployment, are swiftly changing the pattern of farm labor. This development means a new way of life for the agricultural worker, which so far does not offer stability of residence, security, adequate income, or wholesome environment.

Since 1930 hundreds of thousands of farm families have been pushed off the land. Some were ruined by drought; others fell victim to the depression and were foreclosed; thousands of tenants, croppers, and farm laborers were displaced by the introduction of new farm machinery, such as the rubber-tired tractor, the corn picker, and the potato digger.

Most of these uprooted families were forced to take to the highways in search of work. Few found work in industry; the cities were already filled with the unemployed. For the most part the jobs they found were seasonal day labor in the only trade they knew, farming.

The largest employers of these displaced rural families were the mechanized farms, which have been growing in number and extent for a decade. These farms have eliminated most of the resident labor formerly needed, but they still require large numbers of workers, for short periods, to do the hard labor involved in thinning, harvesting, or packing processes not yet fully mechanized.

While mechanization of most of these farms has resulted in increased efficiency, the decrease in labor requirements has been in terms of hours, rather than in total number of workers needed. Socially there is no advantage in this greater efficiency, unless the seasonally employed workers are able to find other jobs between seasons. So far few of them have been able to find such jobs. Under the present system, the large mechanized farm usually supports its workers only during the few weeks of their employment, and they must depend largely on relief between times. In other words, the taxpayer is subsidizing a labor supply for many of the big commercial farms.

Moreover, there has been a great surplus of farm labor, and consequent unemployment even at peak seasons. The migrant families also must travel continually from one crop area to another, as they follow the harvests. Annual incomes of $250 to $450 per family are the rule, and many families make considerably less.

As a result, extremely bad living conditions are common among most of this group of 200,000 to 350,000 families. Usually they find little or no provisions for shelter, health protection, or schooling.

Winter weather brings a sharp increase in cases of pneumonia, influenza, and other pulmonary diseases. The risk of epidemics of smallpox, typhoid, scarlet fever, and similar diseases is a year-round menace.

This problem calls for two solutions. For the surplus workers, a new and more stable employment must be found, perhaps in subsistence farming with occasional seasonal work on the big commercial farms. On the other hand, the mechanized farms need seasonal workers in large numbers. California alone has been estimated to require 170,000 seasonal laborers. If mechanized farming is not to be abandoned entirely, a large group of migrants must continue to follow the crops. For that group, a more satisfactory way of life must be found under a new pattern of employment. These people need decent shelter, better routing into areas where jobs can be found, some

chance to educate their children, and steadier employment which should result from a decrease in the labor surplus.

TYPES OF MIGRANT CAMPS

The migratory-labor camps first constructed by the Administration were intended to provide temporary shelter and a few sanitary facilities for the families following seasonal farm work.

The earliest camps usually consisted of rows of tent platforms, with a few permanent one-room shelters laid out along graveled streets at intervals of about 30 feet.

They were equipped with sanitary units—usually about 1 to each 40 tent platforms—with shower baths, sanitary flush toilets, and a laundry room. They also had an isolation unit for contagious diseases, a nursery, first-aid room, and child clinic, an office and living quarters for the camp manager, and a utility building.

The camp residents elect a campers' committee, which serves as a governing body and represents the entire camp population in its relationship with the management. Most problems of discipline and law and order within the camp are taken care of by this committee. The committee exercises no jurisdiction outside the camp limits, and all its decisions and recommendations are referred to the management for final decision.

Residents furnish their own tents, furniture, and cooking utensils, and finance part of the camp operations themselves. Each family pays 10 cents a day into a general fund, handled by the camp committee and the camp manager. All payments from the fund are made by check, and the accounts are subject to audit by Administration representatives.

Every person in the camp is expected to contribute 2 hours' work a week in return for the general use of the campground; and in case a family is not able to pay cash into the general fund, it usually is required to give 2 extra hours' work a day. The buildings and grounds are regularly inspected by the camp manager, who assigns the clean-up jobs. One of the most important of these is keeping the sanitary units clean.

MOBILE CAMPS AND LABOR HOMES

More specialized types of camps were developed during the year. For example, designs were worked out for small mobile camps, which can be moved by truck from one area to another as the migrant families follow the crops.

The more recent permanent camps also have been provided with a number of permanent homes, each with a small garden. These cottages are rented to families who can find fairly continuous employ-

ment in the neighborhood; and the gardens enable them to supplement their incomes by raising most of their own foodstuffs. This represents a beginning step towards stabilization of at least part of the army of migrant families.

At the end of the fiscal year, the Administration had in operation 1,432 tent platforms, 749 shelters, and 166 labor homes. It had under construction 1,388 tent platforms, 3,414 shelters, and 660 labor homes.

When the present program is completed, 2,906 tent platforms, 4,155 shelters, and 826 labor homes will provide camp facilities for 7,809 families at any one time. These will be divided among 26 stationary and 6 mobile camps located in 7 States—California, Oregon, Washington, Idaho, Arizona, Texas, and Florida.

These measures have been highly effective in relieving misery and in protecting both the migrants and the communities through which they pass from epidemics. They represent only a beginning, however, towards a real solution of the migrant labor problem.

MANAGEMENT OF PROPERTIES

The management and conservation of the investment of the Federal Government in the 193 homesteads projects and migrant camps, having a total value of over $125,000,000, is a continuing function of the Administration. These projects represent an approach to economic security and improving living conditions for 13,930 families on permanent farms and homesteads, and will provide camp facilities for more than 7,000 migrant agricultural families. On June 30, over 100 projects were completed and the others were nearing completion. When finished, the projects will provide homes or camp facilities for 21,804 families.

The operation of the 161 projects involves guidance to families in carrying out sound farm-management plans; in organizing and managing cooperatives; in conducting educational and community programs; in arranging for industrial development on projects needing additional family income; maintenance of physical property; and collection of payments due the Government as rent or for the purchase of farm units.

Projects now in operation fall into two groups, rural and suburban. Aside from the migratory labor camps, the rural projects range from subsistence homesteads to full-time farms. The former class, originated by the Division of Subsistence Homesteads, Department of the Interior, were set up to provide supplementary income to families working in nearby industries.

About half of the full-time farming projects consist of individual farms, located close together so that necessary educational, social, and business facilities may be used in common. The others are made

up of scattered farms. They make use of business and social facilities of the neighborhood where they are located, but usually have cooperative enterprises of their own, such as purebred-sire services.

In addition, there are three suburban housing projects known as greenbelt communities. They are located outside of Washington, D. C., Cincinnati, Ohio, and Milwaukee, Wis., and provide housing for 2,129 families in a rural setting, but within easy reach of large employment centers. Each family may have its own garden, on land included in the project area.

Maintenance and operation of projects has been a function of increasing importance. At the end of the year, $4,262,589 was due for tenure and utility charges. Of this amount, $3,772,904 had been collected. Cumulative delinquencies amounted to less than 12 percent.

Maintenance of properties is financed from reserve funds set up in part out of the rents paid by project families. To pay local governmental agencies for educational and other services supplied to the projects, 1,211 agreements in lieu of taxes were entered into on 98 projects, involving a total payment of $448,841.

In some of the subsistence homesteads communities it has been necessary to supply industries to supplement income from the land. On eight projects, there are now industries; namely, a wood dimension mill at Tygart Valley Homesteads, W. Va.; a pants factory at Westmoreland Homesteads, Pa.; a tractor assembly plant at Arthurdale, W. Va.; and hosiery mills at Bankhead Farms and Skyline Farms, Ala.; Cumberland Homesteads, Tenn.; Penderlea Farms, N. C.; and Red House Farms, W. Va.

During the year, 33 loans, amounting to $2,235,116 were made to newly organized cooperative associations in various communities. Added to loans made in previous fiscal years, this makes a total of $8,841,174 that has been loaned to cooperative associations on the projects. Cooperative associations now number 93 and have a combined membership of over 6,000. These associations make it possible for families in resettlement projects to effect substantial savings as consumers and to obtain higher prices as producers.

As rapidly as possible upon completion, community projects are being conveyed to homestead associations. The membership of these associations consists of all heads of families living on the project. The associations are operated by boards of directors made up of 3 homesteaders and 2 Farm Security Administration officials. All expenses of operation are paid by the association itself, which also transmits to the Government the payments due on each home. To date, there are 14 such associations in operation, and the cumulative delinquency on payments due is only 3.1 percent.

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FIRST ANNUAL REPORT OF THE MANAGER OF THE FEDERAL CROP INSURANCE CORPORATION, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
FEDERAL CROP INSURANCE CORPORATION,
Washington, D. C., September 13, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: Herewith is transmitted the first annual report of the Federal Crop Insurance Corporation for the fiscal year ending June 30, 1939, which covers the period during which "all-risk" crop insurance for wheat was introduced to the wheat growers of the Nation.

As you know, the insurance program for wheat was undertaken as an experiment to determine the feasibility of insurance as a means of protection for farmers against unavoidable crop failure. In line with this purpose, we have endeavored to reflect in this report that experience which has a particular bearing on the problems which were met, both from an administrative and insurance standpoint and what steps have been taken to solve them. The report is necessarily incomplete as to results and conclusions since the crop insurance program will not have ended a full cycle of operations until all losses in connection with the 1939 crop have been adjusted. However, the preliminary results and analysis of the program on the basis of its progress thus far have made it possible to improve the 1940 program now being introduced both from an actuarial and administrative standpoint.

This report is submitted with a recommendation that it be printed.

Sincerely yours,

LEROY K. SMITH, *Manager.*

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CROP INSURANCE IN 1939

With the harvest of the 1939 wheat crop under way, the Federal Crop Insurance Corporation is now completing the first year of an experimental program designed to make "all-risk" crop insurance available

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to wheat growers and to make a field test of insurance principles as applied to growing crops.

The Federal Crop Insurance Corporation was established as an agency of and within the Department of Agriculture under the Federal Crop Insurance Act, which was title V of the Agricultural Adjustment Act of 1938, as approved February 16, 1938. The Corporation was authorized to insure growing wheat, commencing with the crop planted for harvest in 1939. Immediately after the approval of the act, a board of directors, a manager, and other personnel were appointed. Regulations and procedures embodying a comprehensive wheat-insurance plan were drawn up for offering crop insurance to wheat growers in all States and counties where wheat is generally grown.

In developing its program a large amount of information and data were available to the Corporation from past research carried on by the Bureau of Agricultural Economics of the Department of Agriculture, from the experience of private insurance companies which had experimented with crop insurance, from records of the Agricultural Adjustment Administration, and from the study made by the President's Committee on Crop Insurance.

The basic policy of the crop insurance program was guided by the general plan for crop insurance as developed in the report of that committee and as authorized by the act. Also, conclusions drawn from the experience of the Department in conducting other agricultural programs contributed much to the formulation of this policy. An outstanding consideration in policy making was the clear implication that crop insurance for wheat was to be regarded as an experiment, the results of which would measure the possibility of insurance for additional crops.

From this ground work the Corporation was able to establish definite policies to be followed and to set goals toward which the program should be steered. The principal points by which the course of the program was charted are as follows:

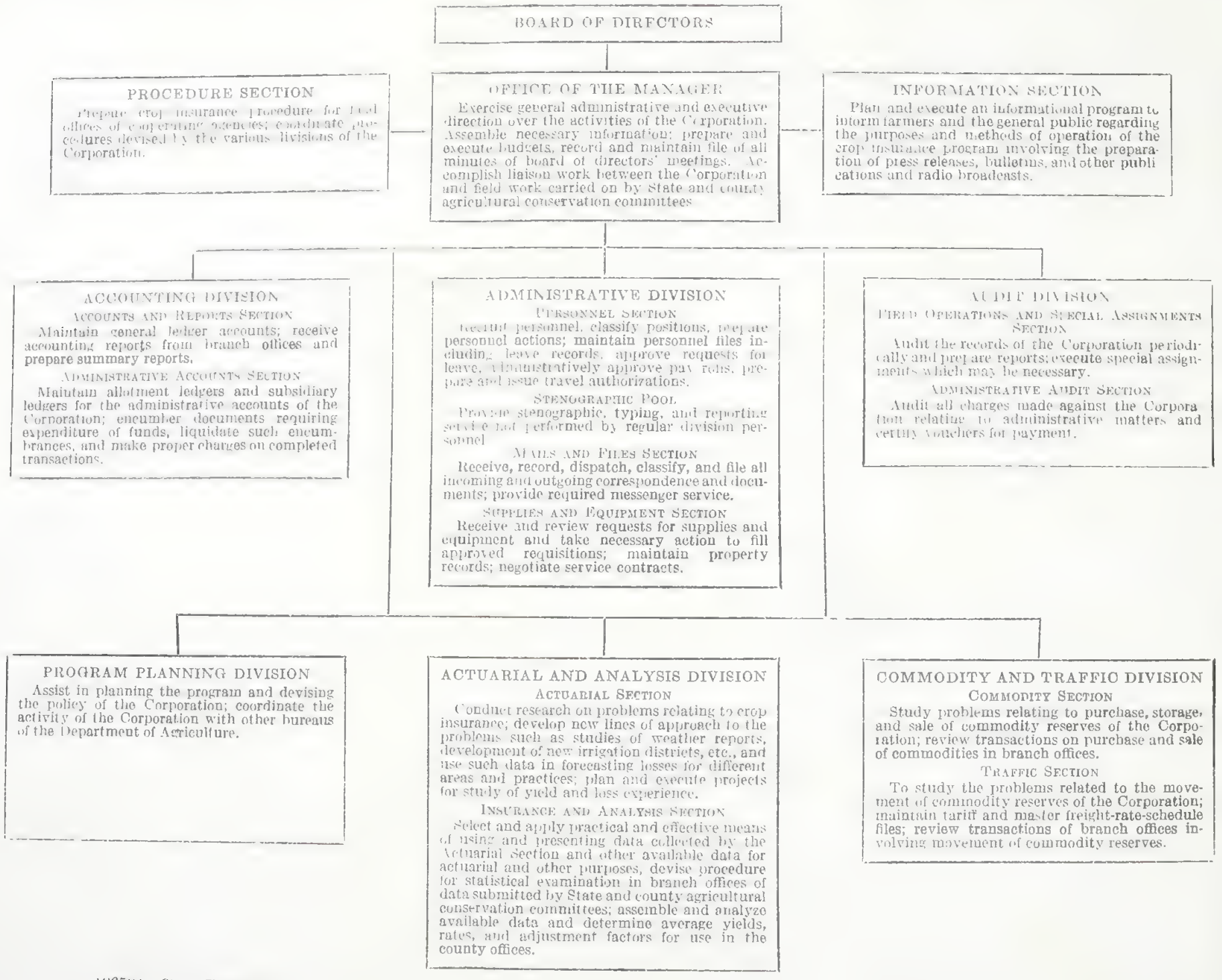
(1) The relatively simple elements of the basic crop-insurance plan should be maintained in presenting the working program in the field. Procedures, forms, inspections, and particularly reports required of the grower, should be kept at a minimum. It was felt that any extraneous elements which might decrease the possibility of obtaining clear-cut results should be kept out of the program.

(2) The insurance principles on which the program is based should have free play. The actuarial calculations should be regarded as scientific data, not subject to change, except for correction of error, or introduction of new information. Also, for the protection of these data, it was determined that the insurance should be written before the crop had grown sufficiently to permit any selection of risk. Further, it was determined that it was highly advisable that the premiums should be paid before the insurance had become operative on farms, thus eliminating the danger that insurance would be taken out most frequently on those farms where the certainty of risk appeared before the policy was in force.

(3) It was considered essential that the program obtain a wide and representative distribution. Without an adequate spread of the risk, an unusual regional crop failure might seem to upset the actuarial basis of the program. Also, it was a duty of the Corporation to

UNITED STATES DEPARTMENT OF AGRICULTURE, FEDERAL CROP INSURANCE CORPORATION

FUNCTIONAL CHART—DEPARTMENTAL SERVICE, JULY 1, 1939



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make the insurance available to as many producers as possible, to demonstrate its operation in all wheat-growing areas under varied conditions, and to collect as much information as possible regarding yields and losses.

(4) It was considered desirable to integrate the operation of the program with other action programs of the Department in order that the crop-insurance program might be operated with a minimum of new personnel and that duplication of effort might be avoided wherever possible. Toward this end, the services of the State and county agricultural conservation program committees were used to present the program to the grower. The cooperation of these committees, trained in administering farm programs, in close touch with growers in their communities, and in possession of records covering acreages and yields on practically all farms in their counties, made it possible for the program to be inaugurated simultaneously in more than 1,300 wheat counties. The program was further coordinated with the agricultural conservation program by making it a policy to accept applications only on farms where soil conservation and good farming practices were being followed.

(5) Primary consideration should be given to the following procedure in making purchases of grain for the insurance reserve: (a) Preference was to be given to wheat in storage in federally licensed warehouses; (b) the price of wheat was to be within the competitive range of the market; and (c) wherever the foregoing requirements were met preference was to be given to farmer-owned cooperative organizations in making purchases.

OPERATING EXPERIENCE

The original operating set-up at the beginning of the Corporation's activities consisted of:

(1) The board of directors, appointed by the Secretary.

(2) The manager, appointed by the board of directors with the approval of the Secretary.

(3) An executive office in Washington, D. C., to conduct policy making and overall administration, direct educational work and research, and coordinate the work of this organization with that of other agencies.

(4) Three branch offices, at Kansas City, Mo., Minneapolis, Minn., and Washington, D. C., to administer the program in the major Winter Wheat Belt, the Spring Wheat Belt, and eastern areas, respectively. These branch offices were responsible for examining applications, computing premiums, collecting premium payments, writing policies, and operating the wheat-insurance reserves.

(5) Two sub-branch offices at Indianapolis, Ind., and Spokane, Wash., to assist in the purchase, storage, and sale of wheat for the insurance reserve in their respective areas.

(6) State supervisors working in cooperation with State and county agricultural conservation committees and county insurance representatives in obtaining applications, recording data for determination of insurable yields and premium rates, collecting premiums, and inspecting insured fields.

(7) County supervisors, especially employed, or members of the county agricultural-conservation-program committee, responsible to the Corporation with regard to financial operations and to the county committee with regard to educational and application work, to conduct sign-up of growers, accumulate information as to yields and rates, collect premiums, and inspect insured fields.

Attention is called to the functional chart facing page 3 which more clearly shows the administrative relationship of the various divisions and sections of the Washington office.

Seven steps were involved in the program as originally laid down: (1) Taking the growers' applications, at which time either historic

or appraised yields were recorded for the farm for the base period; (2) approving the application, computing the premium payment in the branch offices, and notifying the grower of the amount due; (3) collection of premiums by county insurance representatives; (4) issuance of the policy by the branch office; (5) inspection of the insured fields; (6) notification by the farmer of any damage to the crop; and (7) adjustment and settlement of the loss.

The administrative machinery of the Corporation was of necessity established on the basis of the best estimate of the work that would be required, without benefit of any precedent. The tendency for growers to wait until the last few days before dead lines before applying for insurance, or before making premium payments, brought the work involved in checking applications, computing premiums, purchasing grain, and writing policies to an extremely sharp peak in the branch office serving the principal winter wheat States. This in turn necessitated large increases and hurried training of new personnel. For example, in the Kansas City branch office, which bore the brunt of this load, it became necessary to increase the number of employees from 400 to 800 in the course of 2 weeks. Considering the fact that the original group of workers was still inexperienced, this presented a major administrative problem.

Under such conditions, some wasted effort was inevitable, but important lessons were learned from a procedural and work-production standpoint. As a result of this initial experience, the Corporation has made many administrative improvements that will permit the handling of insurance contracts to proceed more smoothly and economically. Schedules of sign-up in the field have been moved ahead to spread the flow of applications over a long period. The elimination of several steps in the process of writing insurance has been made possible under new procedures which will be discussed later. The number of branch offices has been increased from three to five. They are located in Washington, Chicago, Kansas City, Minneapolis, and Spokane, each serving a smaller and more accessible area. Personnel in each branch office have been carefully trained in the procedures involved in handling the work.

Whereas the 1939 program was necessarily geared to the planting season, with consequent sharp peak loads of work occurring in the fall and spring, it has been possible under the 1940 program to schedule a uniform flow of work through the branch offices, with much of the preliminary work on actuarial data completed prior to the application-taking period. In turn, this has provided a more even distribution of work required of State and county committees. As a result of the improvements in the program and the fact that the Corporation now has a corps of trained, classified, and formally appointed employees, it is believed that a considerably larger load can be handled with fewer temporary employees.

TAKING THE PROGRAM TO THE FIELD

EARLY RESPONSIBILITY FOR THE ADMINISTRATION

Soon after the passage of the Federal Crop Insurance Act the five regional divisions of the A. A. A. agreed to assume a large part of the responsibility for administering the crop-insurance program through their established regional, State, and county officers in order

to develop crop insurance as an integral part of the ever-normal-granary plan for wheat growers. Coordinators were selected in the three main wheat-producing regions—western, north central, and southern—to integrate the crop-insurance activities with the other phases of the national agricultural program. Persons already employed in the other two divisions of the A. A. A. were assigned to coordinate the work there.

State crop-insurance supervisors were selected in 19 of the main wheat-producing States to devote all or most of their time to the crop-insurance program. These supervisors were appointed by the divisional directors, with the approval of the manager of the Federal Crop Insurance Corporation. In certain States where wheat was of minor importance a member of the State committee or some other regular employee in the State office assumed the duties of a State crop-insurance supervisor.

The State crop-insurance supervisors worked closely with the State committees, but in many instances exercised considerable independent judgment in the administration and supervision of the crop-insurance phase of the program within the State.

In each wheat county a crop-insurance supervisor was appointed by the county committee, with the approval of the State crop-insurance supervisor, to supervise the crop-insurance program and represent the Corporation in regard to the acceptance of premiums. Frequently, crop-insurance representatives were selected by the crop-insurance supervisor, with the approval of the county committee, to personally present crop insurance to the farmers in the county. The extent to which the crop-insurance representatives were used varied greatly from county to county and from region to region. Probably in the north-central region greater emphasis was placed on the personal solicitation by crop-insurance representatives than in any other area.

PRESENTATION OF THE PROGRAM

The crop-insurance program was officially launched at a national meeting at Omaha, Nebr., on April 19 and 20, 1938.

Following the Omaha meeting, a series of State meetings was held to acquaint State workers in the A. A. A., farm-organization leaders, extension workers, and others interested in the details of crop insurance as it applied to their respective areas. Initial State meetings conducted jointly by representatives of the A. A. A. and the Federal Crop Insurance Corporation were held in the various States of the respective regions.

District and county meetings were scheduled for the purpose of training county committeemen, county crop-insurance supervisors, county agents, farm leaders, and others in the administrative and educational features of the program.

Community educational meetings designed to acquaint local farmers with the purposes and advantages of crop insurance were conducted by the trained county people.

A few counties were successful in securing the signing of applications at these educational meetings or at a later sign-up meeting. On

the other hand, the majority of counties found that it was necessary to supplement the educational or sign-up meetings with an intensive personal-solicitation campaign carried on by crop-insurance representatives.

In most States the agricultural extension service was instrumental in assisting with the presentation of the crop-insurance program to the farmers by helping them grasp the philosophy and advantages of the program. Farm organizations did much to emphasize the advantages of crop insurance.

APPLICATIONS WRITTEN AND POLICIES COMPLETED

The period for writing applications extended from about July 1, 1938, in the early winter-wheat States until March 1, 1939, in the spring-wheat area. During that time approximately 305,000 applications were executed in 1,263 counties of 32 States. In securing these applications about 800,000 farmers were personally interviewed. Approximately 54 percent, or 165,000, of the applications matured into policies.

The A. A. A. State and county agricultural-conservation committees have displayed a genuine interest and have taken an extremely active part in carrying out this program with respect to the particular problems, conditions, and needs of each State and locality. Notable progress has been made by the committees in giving guidance and soundness to local administration of the program and in the correlation of the work so that each phase of the general agricultural program is given due emphasis.

APPRAISAL OF PARTICIPATION

Upon examination of the participation in the light of the objectives and policy of the program, it is apparent that the program in its first year has accomplished its purpose of demonstrating the possibilities of crop insurance on a Nation-wide basis. Some insurance was written in practically every community in which wheat is a significant crop. Enrollment in the program has been fairly representative of the various types of farming in the various areas in which wheat is grown. Participation has not been limited to any one area nor to farmers for whom wheat is a major crop.

Table 1 shows statistically, by States, the results obtained up to June 30. These statistics do not, however, reflect the many purely local factors which influenced the sign-up and payment of premiums, such as availability of wheat, cash, or credit, or the lack of them at the time premiums were due, the recent yield experience, local weather and soil-moisture conditions at the time applications were filed, or the method of local approach used in presenting the program to farmers.

TABLE 1.—*Statistical report of crop-insurance program from beginning of operations in 1938 through June 30, 1939, by States* [1]

State	Policies issued	Total insured acreage	Total insured production	Average insured production per policy	Total premiums		Average premium per policy	
					In bushels	In cash equivalent	In bushels	In cash equivalent
	Number	*Acres*	*Bushels*	*Bushels*	*Bushels*	*Dollars*	*Bushels*	*Dollars*
California	1,005	112,903	1,576,937	1,569.09	74,501	47,192.99	74.13	46.95
Colorado	1,443	72,166	585,842	406.00	78,364	35,195.37	54.31	24.39
Delaware	79	1,761	22,145	280.32	874	540.92	11.06	6.84
Idaho	1,727	135,998	2,150,260	1,245.08	81,440	32,988.78	47.16	19.10
Illinois	12,227	275,515	2,950,340	241.32	187,012	104,088.18	15.30	8.15
Indiana	11,185	168,864	2,063.010	184.44	145,435	82,583.78	13.03	7.38
Iowa	4,675	75,918	913,410	195.38	57,998	30,896.04	12.41	6.60
Kansas	15,017	892,682	7,520,983	500.83	778,352	376,588.40	51.83	25.07
Maryland	986	23,055	291,430	295.53	11,288	7,033.06	11.45	7.13
Michigan	5,072	52,310	774,148	152.63	31,997	18,530.63	6.31	3.65
Minnesota	10,529	309,677	2,644,913	251.20	199,678	118,958.79	18.96	11.29
Missouri	15,846	365,986	3,335,340	210.48	200,929	107,680.63	12.68	6.79
Montana	5,253	555,381	4,499,954	856.54	708,382	324,788.51	134.85	61.82
Nebraska	13,350	447,822	4,166,911	312.12	507,693	248,029.08	38.02	18.57
Nevada	34	667	13,121	385.91	525	262.75	15.44	7.72
New Jersey	29	380	5,778	199.24	190	130.45	6.55	4.49
New Mexico	111	9,362	81,724	736.25	13,644	6,371.21	122.92	57.40
New York	652	8,769	150,106	230.22	5,194	3,236.13	7.96	4.96
North Dakota	27,093	2,168,134	12,663,104	467.39	1,994,192	1,075,036.97	73.61	39.68
Ohio	10,314	131,078	1,807,177	175.22	136,543	83,357.07	13.24	8.08
Oklahoma	8,695	484,363	4,065,238	467.53	280,566	137,569.02	32.27	15.82
Oregon	679	96,365	1,420,294	2,092.77	64,818	32,990.69	95.46	48.60
Pennsylvania	2,301	30,432	448,927	195.10	16,599	9,929.32	7.21	4.31
South Dakota	10,035	503,755	2,679,764	267.04	695,643	378,438.95	69.30	37.71
Texas	3,691	355,312	2,543,280	689.21	397,167	200,429.96	107.60	54.30
Utah	454	33,631	523,863	1,153.90	23,039	7,628.37	50.75	16.80
Virginia	916	15,384	189,240	206.60	7,843	4,944.36	8.56	5.39
Washington	1,366	182,751	2,428,914	1,778.12	91,728	44,593.29	67.15	32.64
West Virginia	1	37	402	402.00	18	11.10	18.00	11.10
Wisconsin	184	1,544	16,836	90.95	1,352	757.83	7.34	4.11
Wyoming	322	24,137	214,410	665.87	29,947	12,281.38	93.00	38.14
Total	165,271	7,536,139	62,748,101	379.12	6,822,956	3,533,064.01	41.28	20.80

[1] The figures are tentative and subject to revision. Also, progress under the program is not uniform between States and areas on account of climatic and other conditions so that exact comparisons may be misleading.

ADJUSTMENT OF LOSSES

The adjustment of crop losses under the 1939 crop-insurance program was well started by June 30, 1939. Approximately 5,000 loss claims, representing more than 1,000,000 bushels of indemnities, were approved in the county offices by this date.

To assist the county committees in determining the amount of indemnities due, adjusters were selected by county committees to work under their direction. These adjusters were farmers living in the counties where they worked, and were familiar with the farming practices of individual farmers; the adjusters were fully acquainted with the operation of the general farm program and had the respect of farmers in the communities in which they worked. While the adjusters were not permitted to make commitments as to what the final settlements would be, their recommendations on adjustments were ordinarily followed, after careful examination by the county committees and review by the State and branch offices.

Where wheat was threshed, the determination of loss was a comparatively simple matter of arriving at a total production figure and determining the amount by which the total production fell below the insured production.

Probably the most difficult matter of the adjustment phase of this program came in connection with the first losses. Shortly after January 1, 1939, county committees began to receive notices of damage to the crop. Since acreage planted to wheat which was totally or substantially totally destroyed was permitted to be put to other uses with the approval of the Corporation, there were a great many requests for this privilege. This required appraisal of the potential yield of the wheat crop on the basis of the most favorable growing conditions prevailing until harvesttime. This phase of loss adjustment was particularly important and difficult to handle. Farmers who had requested release of acreage ordinarily wanted release at the earliest possible date so that the acreage could be planted to some other crop. It can easily be seen that it would be difficult at times to arrive at an agreement between the adjuster who had appraised the potential yield, and the insured. However, owing to the tactful manner in which this phase of the program was handled, agreements were reached in practically all cases.

While adjustment work will not be completed until the spring wheat crop is harvested, the large number of adjustments made to date has provided a basis for appraising this phase of the program. The Corporation has made a careful study of adjustments through audit of claims received and from field check-ups of individual cases, and finds that most adjustments are fair both to the individual farmer and to the Corporation. When the validity of the claim for indemnity has been established by local committeemen or adjusters, settlements have proceeded with dispatch. In most cases farmers have received indemnities within 2 weeks after the adjustment of their claims. It can be concluded that adjustments can be serviced equitably and speedily under the present system.

Obviously, the indemnities paid by the Corporation on the 1939 crop cannot be reported accurately until the adjustment work is complete.[1] Early estimates indicate that losses may run somewhat in excess of premiums collected, but this is subject to change depending on the outcome of the spring wheat crop. Crop losses in the winter wheat area have been particularly severe in those localities in which the highest acreage was insured.

Undoubtedly a contributing factor to the probability of an excess of indemnities over premium payments has been the adverse selection of risks in certain localities where the crop was deteriorating at the time the premiums were paid. This was not true in all areas, however, since some of the most extensive losses have occurred in areas where the crop appeared to be in better-than-average condition at the time premiums were paid. The fact that some selection occurred emphasizes the desirability of writing the insurance prior to seeding of the crop, thus eliminating any opportunity for adverse selection of risks on the basis of crop conditions.

MAJOR FIELD PROBLEMS

In the development and administration of any program on as broad a scale as the Federal crop-insurance program, certain diffi-

[1] As of September 1, with adjustment work complete in the Winter Wheat Belt and well under way in the Spring Wheat Belt, 21,000 indemnity claims had been approved for payment, involving disbursement of 4,301,563 bushels of wheat.

culties and problems would be expected to arise. Some of the major difficulties and the attention given to them are briefly summarized as follows:

(1) The inability of county personnel to inform the individual farmer definitely of the yield and premium rate for the farm at the time the applications were written discouraged many farmers from making application. This has been largely overcome in the 1940 crop-insurance program by the establishment of yields and premium rates on all farms prior to the time for writing applications. This enables the county committee to tell each grower what his average yield and premium rate are before he signs an application.

(2) The lapse of time between the signing of the application and the issuance of premium notices was an important factor causing failure of certain applicants to pay their premium. It required additional effort on the part of committeemen and crop-insurance supervisors to collect premiums after the farmer's initial interest had lagged. The 1940 regulations require that premiums be paid at the time the application is taken. The insurance transaction can be closed in one interview with the individual, thus shortening the procedure and effecting substantial saving in administrative cost in the counties.

(3) The inability of a great many of the farm operators to pay their premium in wheat or cash from their own resources and their inability to secure credit with which to pay premiums seriously interfered with the writing of policies. These financial difficulties were caused largely by extended droughts and low prices. Some private and Federal lending agencies were able to assist certain individuals to pay their premiums by taking a crop mortgage and an assignment of the policy, but even so, many were unable to pay the premium due.

The difficulties growers faced in financing premiums were materially relieved by Congress in March of 1939 when the Soil Conservation and Domestic Allotment Act was amended to permit growers to obtain advances for premiums against future payments to be earned under the agricultural-conservation program and other programs administered by the Department of Agriculture. This action was taken in time to enable a large number of growers in the Spring Wheat Belt to obtain insurance who otherwise could not have done so. It is expected to have widespread application in the 1940 program.

(4) At the time the program was taken to the field, there was no definite, clear-cut knowledge of how adjustments of losses were to be made, and this undoubtedly was a deterrent to a great many potential policyholders. Some farmers had the feeling that it might be well to let the program function for a year and see how losses were paid before they participated in the program.

The loss-adjustment procedure, which was taken to the field during the early part of the present calendar year, has worked out very satisfactorily. In general, county committees were apprehensive concerning the job of adjusting losses. The procedure developed, however, was so workable that they have had very little difficulty in adjusting losses. In the main, claims have been handled promptly, and farmers are well pleased. A great many of those who were in-

different about crop insurance in the fall of 1938 are now quite enthusiastic about the entire program. Since the 1939 loss-adjustment procedure has been quite successful, it is assumed that the adjustment pattern is rather definitely set and that only minor changes will need to be made to keep it in line with the changes in the regulations for the 1940 program.

(5) Yields were so low and premium rates so high on farms in the western part of the Great Plains that many producers did not feel it practical to buy insurance. Thousands of farms in that area have a history of production that does not permit coverage greater than 5 or 6 bushels an acre, and they have a loss experience of more than 2 bushels an acre.

In much of this area a marked improvement in wheat-production practices is noted in that the summer-fallow area is greatly expanded, the basin lister is now used more extensively, improved varieties of wheat are helping to meet problems of rust and drought, and timely seeding and harvesting with improved machinery have increased net yields. On the other hand, the production from much new land was included in the base period, whereas losses in soil fertility have already greatly lowered the productivity of some of the land.

The development of the special yield and rate procedure for 1940, which recognizes the influence of certain improved practices on yields, has been designed to meet to some extent these changing conditions. Consequently, where such practices and methods can be evaluated and reflected in yields and premium rates, increased participation can be expected. This problem is one requiring continued research and the accumulation of much information.

(6) Hesitancy to apply for insurance in certain low-risk, high-yielding areas has been noted. In the extreme West, fire is one of the main hazards affecting wheat crops, and farmers were inclined to continue to rely upon commercial fire insurance rather than change to the Government all-risk policy, because the commercial fire insurance covered "spot" or partial losses, while the Government insurance policy paid indemnities only when less than 50 percent or 75 percent of an average crop was produced.

Commercial rates covering the one hazard of fire appeared low in comparison with the more inclusive all-risk policy offered by the Corporation. However, the experience during 1939 with deficient rainfall throughout much of the Pacific coast area may have an influence on this attitude for 1940 and later years.

(7) It was originally anticipated that all insurance would be in force at planting time or shortly thereafter. However, this was not possible in all cases in the 1939 program for a number of reasons. It was necessary to obtain yield data from each grower at the time he applied, and the sharp peak in applications brought a great load of this work at one time. It was also necessary to compute the average yield and premium rate, and the cash equivalent after the application was received. Also, in the Winter Wheat Belt many growers had not received their acreage allotments at the time premiums were due; consequently many changes were required in applications, premium notices, and policies.

As a result of these unavoidable delays it was not possible in the Winter Wheat Belt to notify some growers of the amount of premium due until after the crop was planted and had started to grow, thus making it possible for growers to base payment or nonpayment of premiums on the condition of the crop. County committees were instructed to accept no premium payments from growers whose crops had deteriorated after the expiration of the original date at which their premium was payable. It was apparent that in some areas, however, particularly those in which premium rates were high, growers withheld premiums if the crop looked promising, or paid if it appeared to be losing ground. This problem has been partially eliminated from the 1940 program by the fact that rates are available well in advance of application taking, and it is possible and equitable to require that all premiums be paid before the crop is seeded.

CHANGES IN FIELD ADMINISTRATION

After the 1939 program had been under way for some months it became evident that closer coordination should be effected between the agricultural conservation program and the crop-insurance program. This could be accomplished by transferring more of the responsibility for the conduct of the program to State and county committees. Therefore, on January 3 the dual responsibility of State crop-insurance supervisors and county-insurance supervisors was abolished, and field work involving writing of applications and adjustment of losses was placed directly under the supervision of county committees, State commmittees, and regional divisions of the Agricultural Adjustment Administration. The branch offices of the Corporation were limited to work involving approval of yields and premium rates, auditing of policies and receipts, writing of policies, purchase and storage of grain, audit of adjustments, and computation of cash equivalent settlements.

This coordination which tied the crop-insurance program more closely into the regular plan of work of the county and State committees in administering the agricultural conservation program should result in many economies in administration by avoiding duplication of effort. It is felt that this synchronization of field work, together with the simplification of the plan, has made crop insurance a "straight line" operation, with delay and expense held to a minimum.

WHEAT OPERATIONS

An innovation of the wheat-crop insurance program was the principle of writing the insurance "in kind," and of carrying the insurance reserves of the Corporation in actual wheat in storage. This "all wheat" idea was carried out by calculating all insurable yields, premium rates, and indemnities in bushels of wheat. The Corporation undertook to accumulate wheat for the insurance reserve at the rate and to the total amount of the payment of premiums by farmers, and to reduce the reserve only through payment of indemnities.

The "all wheat" phase of the insurance program was designed to eliminate the effect of fluctuations of wheat prices from the basis

of the insurance. However, it was anticipated that this entirely new method, without parallel in previous commercial insurance, would develop some puzzling questions. One of the first tasks, in the computation of cash equivalent of premiums and indemnities, was that of perfecting a method of pricing wheat so as to reflect the price of wheat at the grower's local shipping point.

ESTABLISHING BASIC MARKETS

To achieve a uniform method of determining cash equivalents in any locality, a study was made of the normal movement of wheat to market and of the price-basing structure. From this it was possible to designate certain markets as basic markets and to assign to each the local points from which the wheat supply normally flowed. Schedules were compiled showing the freight rates on wheat from nearly every local station in the United States to the various basic markets. From these schedules it was possible to arrive at the cash equivalent of wheat at any local station on a given day by deducting from the basic market price the freight and handling charges per bushel. In some minor areas where freight rates were not a factor in determining local prices, the Corporation devised methods to reflect the actual prices growers received at local stations for their wheat.

In order to allow growers to pay premiums in wheat, the branch managers of the Corporation were authorized to designate warehouses which met the requirements of the Corporation as collection warehouses. All federally licensed warehouses were available as collection warehouses.

The administrative officials of the Corporation realized that local handling of wheat received from growers would involve some complications. In many cases individual premiums would amount to less than a carlot of wheat, and when a carlot of wheat was finally assembled at a country point it might grade mixed wheat, for which the Corporation would be penalized when the wheat was sold.

Further, local storage of wheat might jeopardize the reserve because of lack of uniformity of State warehousing laws and the difficulty of obtaining adequate protection for Corporation wheat stored in local warehouses. Some States have no warehousing laws, and in many States supervision of warehouses is almost wholly lacking.

However, by the time premiums were paid, the bulk of the wheat had moved to market, and less than 1 percent of the growers paid their premiums in wheat. This small number was handled by allowing county insurance supervisors to sell the warehouse receipts covering such wheat back to the warehouses issuing them. The prices obtained for this wheat were verified in the branch offices of the Corporation.

It is probable that a larger percentage of growers will pay premiums in wheat during the coming season since premiums are payable earlier in the season. However, the Corporation plans to follow the same course of selling such wheat back to local warehouses

and investing the proceeds in wheat in storage at selected warehouses since this permits handling of wheat receipts at the least expense and provides the greatest security for reserves.

It was considered necessary for the Corporation to place in its reserve a quantity of wheat equal to the total number of bushels collected as premiums in order to protect itself against price fluctuations. However, most of the wheat available for purchase by the Corporation was either at terminal or subterminal markets, and practically all of such wheat included in its value the freight billing behind it, and consequently had more value and cost more per bushel than the same amount of wheat at points where premiums were collected.

Accordingly the Corporation adopted the policy of supplementing the cash proceeds of premium payments with capital funds to enable the purchase of 1 bushel of wheat for each bushel of premium, in effect investing a part of such funds in paid-up freight and other charges which were an inherent part of the value of such wheat. These funds used from the capital are recovered as the wheat reserves are disposed of in payment of indemnities.

Table 2 summarizes the wheat transactions of the Corporation through June 30, 1939.

TABLE 2.—*Wheat transactions through June 30, 1939*

Item	Quantity	Value
	Bushels	*Dollars*
Kansas City branch:		
Purchases	3,391,054	2,155,263.84
Sales	1,126,765	808,232.93
Inventory June 30 (net cost)	2,264,289	1,434,515.75
Minneapolis branch:		
Purchases	3,836,782	2,834,378.09
Sales	76,995	53,993.38
Inventory June 30 (net cost)	3,759,787	2,780,699.55
Total:		
Purchases	7,227,835	4,989,641.93
Sales	1,203,760	862,226.31
Inventory June 30 (net cost)	6,024,076	4,215,215.30

The Corporation had remaining on hand as of June 30, 6,024,076 bushels of wheat, costing $4,215,215, or an average of 69.9 cents a bushel.

STANDARD STORAGE RATES

Up to June 30 the Corporation had entered into 61 standard storage agreements providing for storage of the Corporation's wheat at rates of one-thirtieth of a cent per day for the first 6 months of each year, with free storage for the remaining 6 months.

In the Kansas City branch-office area and in Washington and Oregon it has been possible for the Corporation to store its wheat at subterminal and country locations, but in the area served by the Minneapolis branch office it has been necessary to concentrate the wheat reserves at Minneapolis and Duluth-Superior. Most of the warehouses at country points in the spring-wheat area do not have sufficient space to store wheat when crops are moving, and State laws permit wheat to be shipped to terminal warehouses without canceling the outstanding warehouse receipts issued by the country warehouses.

Obviously, the Corporation could not store wheat under such conditions at country points in the spring-wheat area.

Some difficulty has been experienced in securing storage space in the Pacific Coast States and in the intermountain region due to the low storage rates prescribed by State laws. The usual rates are $1 per ton for handling, including 30 days' free storage and 10 cents per ton per month for storage. On the basis of these rates, warehouses would receive 6.3 cents per bushel for the first year and 3.6 cents per bushel per year thereafter. Because of the fact that the handling charge does not recur each year, warehouses in these States insist that wheat be loaded out before the new crop starts moving. This made it impossible to secure storage on the long-term basis essential to the Corporation's needs.

Therefore, the Corporation was faced either with the necessity of paying higher storage rates than those prevailing in the Pacific Coast States and intermountain region, or of converting premiums received from these States into wheat in some other area. Because of the changes in the spreads between these wheat markets and those in other areas and the possibility of losses, it was deemed advisable by the Corporation to store a portion of its wheat in the intermountain area, and pay the same storage and handling rates to warehouses in this area as it does in other areas.

The board of directors of the Corporation has approved this plan, which should enable the Corporation to secure adequate storage space on the Pacific coast and in the intermountain region.

Attempts are being made to secure more storage space at country points in the area served by the Kansas City branch office. To this end, over 2,400 local elevators have been asked whether they would be interested in entering into a storage agreement with the Corporation. Replies are being received to this inquiry, and it is possible that this year the Corporation can have its wheat reserves in the Kansas City branch area more widely distributed.

Before entering into its wheat operations, the Corporation arranged for the cooperation of the officials in charge of the administration of the United States Warehouse Act to assist it in keeping advised as to the condition of its stocks stored in federally licensed warehouses. The supervisors of this administration render condition reports on this wheat and advise the branch managers of the Corporation when conditioning is necessary. When requested, they also make special examinations for the Corporation. This assistance has made it possible for the branch managers for the Corporation to know of the condition of such of the wheat reserves of the Corporation as are stored in federally licensed warehouses.

As of June 30, the Corporation had its stocks of wheat at 26 locations in the Kansas City branch area. The Minneapolis branch office had wheat stored at Minneapolis and Duluth–Superior; wheat was stored at 14 locations in Washington and Oregon.

The storage of the wheat of the Corporation, by States, is shown in the following tabulation:

Wheat in store as of June 30, 1939

Location	Quantity stored
Kansas City branch:	
Iowa:	*Bushels*
Council Bluffs	105,000
Kansas:	
Arkansas City	80,000
Concordia	21,492
Dodge City	190,000
Hays	4,000
Hutchinson	265,000
Wichita	250,000
Yocemento	3,500
Zenith	6,000
Total	819,992
Missouri:	
St. Louis	176,987
Nebraska:	
Central City	5,000
Columbus	16,285
Cozad	1,675
Grand Island	45,000
Hastings	30,000
Kearney	7,500
Omaha	380,000
Schuyler	80,000
Total	565,460
Oklahoma:	
Cherokee	2,000
Enid	115,000
Homestead	10,000
Ingersol	6,000
Oklahoma City	56,438
Total	189,438
Texas:	
Amarillo	60,000
Fort Worth	297,411
Kansas City branch—Continued.	
Texas—Continued.	*Bushels*
Wichita Falls	50,000
Total	467,411
Total Kansas City branch	2,264,288
Minneapolis branch:	
Minnesota:	*Bushels*
Duluth	796,000
Minneapolis	1,549,563
St. Paul	619,425
Total	2,964,988
Oregon.	
Bourbon	672
Condon	1,187
Grass Valley	1,806
Ione	8,197
Klondike	1,438
Rufus	1,179
Wasco	3,820
Total	18,299
Washington:	
Asotin	5,491
Fallon	2,817
Pomeroy	6,147
Spokane	84,704
Spring Valley	5,200
Vancouver	15,000
Waverly	7,140
Total	126,499
Wisconsin:	
Superior	650,000
Total Minneapolis branch	3,759,786
Grand total	6,024,074

PAYMENT OF INDEMNITIES

Farmers who have suffered losses to insured crops may request that their indemnities be paid in the form of wheat or the cash equivalent. The Corporation has endeavored to follow the grower's requests wherever possible, but certain practical considerations sometimes make it necessary for the Corporation to exercise its option to pay the grower in some other form than that which he has requested. In every case, of course, the grower receives the same value of indemnity, whether paid in wheat or cash.

If a grower receives his indemnity in "flat wheat," i. e., wheat without freight charges or freight billing behind it, at his local station, the number of bushels is the same as that stated in his indemnity claim. However, very few payments of this type can be made, since the Corporation receives premium payments and acquires its wheat after the bulk of the crop has moved to market and has little opportunity to acquire flat wheat at local stations.

Most of the reserves are stored in large elevators and have moved to the storage point by railroad. Thus they have acquired a higher

value per bushel than wheat at local stations. Consequently, in turning such wheat over to growers, the difference in value must be taken into account and adjusted by reducing the number of bushels to which the grower is entitled. This has caused some misunderstanding among growers, who have not taken into account that the wheat they received was worth more per bushel, because of its location at the basic market, and consequently, that it took fewer bushels to equal in value the number of bushels of wheat of their indemnity at the local station.

Another practical consideration is the fact that where individual indemnities call for less than a carlot of wheat, it is uneconomical for the grower to ship the wheat, and further, the splitting of warehouse receipts and freight bills into denominations necessary to pay indemnities in wheat would place a heavy burden on the Corporation, the elevators, and the railroads. Therefore, the Corporation has adopted a policy of paying indemnities in wheat, if so requested, but because of the difficulties present in making payments where less than a carlot of wheat was involved, such payments were discouraged when the quantity of wheat to be delivered was less than 1,000 bushels. An exception is made, of course, where flat wheat is available. In cases where the indemnity is less than 1,000 bushels, the insured grower is mailed a check equal to the value of his indemnity with a letter explaining why the Corporation feels it is not advisable to pay his indemnity in wheat as requested. A statement is sent along, showing at what point the Corporation can deliver wheat, the quantity the grower would receive, and describing the freight bills which would be delivered with the wheat. Then, if the grower desires, he can return the check and receive the wheat and the freight bills instead.

Where wheat has billing behind it for paid-up freight, the Corporation has endeavored to explain to growers that such wheat carries the privilege of moving on to the ultimate market at a substantial saving in freight costs over local movement from the same point, and that this increases the value of the wheat per bushel by the amount of the saving in freight. Where such wheat is delivered to the grower, the number of bushels of indemnity is calculated to give him the same value as if he received the cash equivalent, or flat wheat at his local station.

The Corporation anticipated the difficulties incident to paying indemnities in wheat and has acquired as much flat wheat as possible. Also, it is endeavoring to secure more storage space at country locations. However, the opportunities in this respect are limited by the fact that the Corporation purchases its wheat after the principal movement to market and because there is little or inadequate supervision of warehouse facilities at country points in many States.

THE ACTUARIAL BASIS FOR WHEAT-CROP INSURANCE

BASIS FOR THE 1939 PROGRAM

County figures for average yields and average loss experience were available when the program started as the result of research carried on by the Bureau of Agricultural Economics prior to the organization of the Corporation. The loss-experience figure for each county was the result of analysis of a sample of individual farms based on

the 6 years 1930–35, and adjusted to the 10-year (1926–35) basis through the use of county yields prepared by the Division of Crop and Livestock Estimates. The annual-yield figure for the county was the average of these yield figures for the 10-year period 1926–35.

YIELDS AND RATES FOR INSURANCE CONTRACTS

For the Federal crop-insurance program, each insured farm had a separate yield and separate premium rate. In the 1939 program, the yield for the farm was the average of the yields per seeded acre on such farm during the 6-year period 1930–35, adjusted to reflect the experience for the 10-year period 1926–35. If annual-yield records were not available for the farm, the average yield was appraised.

The premium rate for the farm was determined by first computing the loss experience for such farm for the 6-year period 1930–35 from the annual-yield data, and adjusting such loss experience to the 10-year period 1926–35. The 10-year loss experience for the farm was then averaged with the 10-year loss experience for the county to determine the premium rate for the farm.

Yields and premium rates vary widely, depending on the productivity and the production risks on the farm. Some idea of the range in yields and rates can be obtained from table 3.

TABLE 3.—*Representative counties showing variations in yields and premium rates*

County and State	10-year average yield for county	Average premium for—	
		75-percent coverage	50-percent coverage
	Bushels		
Sandusky, Ohio	21.7	1.1	0.4
Golden Valley, N. Dak.	8.9	1.6	.8
Morton, Kans.	7.7	2.3	1.5
Whitman, Wash.	26.4	.5	[1] .2
York, Pa.	20.2	.6	[1] .1

[1] Policies subject to minimum premium rate.

It became apparent early in the application period that it would be impossible to obtain for the majority of the farms reliable and applicable annual wheat-yield records for each year of the base period. Consequently, most of the applications were being submitted on the basis of an appraisal of the average-yield and average-loss experience. Moreover, county committees were having difficulty in making proper appraisals. There was a strong tendency to appraise all farms at a figure near the county average rather than to appraise each farm on its own merits.

To meet this difficulty a procedure was devised in July 1938 by which the county committees selected key farms in the county for which historical data were available and determined yields and loss experience for such key farms and located them on a county map. Appraisals of yields and loss experience submitted thereafter were required to be based on one or more of such key farms rather than upon the county average figures. This resulted in a substantial improvement in the figures submitted on an appraisal basis.

After the application period, the yield and loss experience submitted on applications were analyzed, and the averages were compared with the average yields and loss experience as shown in the actuarial tables for the sample farm and with the Division of Agricultural Statistics' yields for the same years.

It appeared that the Corporation in the 1939 program wrote insurance for higher yields, on an average, and lower premiums, on an average, than accumulated data indicate should have been done. Field representatives believe that the farmers taking insurance were better-than-average farmers and, if such was the case, the higher average yields and lower premiums may have been justified. It is undoubtedly true, however, that in some counties the insured yields were too high, and the premium rates too low. Provision has been made in the 1940 program to factor yields and premium rates to meet a county check figure. This, as described later, will provide an automatic control so that the difficulty encountered in the 1939 program will not recur.

Another troublesome problem was the determination of yields and rates on farms where such special practices as summer-fallow had been followed in recent years. Applicants for insurance were unable to furnish long-time records of yields on summer-fallow to compute average yields and premium rates, either because they had not followed such practice during the full length of the base period or because they had not kept separate records on the portion of their wheat acreage that was seeded following fallow. Practically the only data available were experiment-station records, and usually the yields shown in these records could not be used in establishing yields for individual farms in the area. Furthermore, the program last year provided for only one rate and one yield so that if an applicant was planning to seed wheat both on fallowed and nonfallowed land the yield and rate had to be based, in part, on the wheat acreage under each practice. Thus, the establishment of yields and premium rates for summer-fallow and continuous cropping was not very satisfactory.

In the 1939 program there was also some dissatisfaction and criticism in counties because the farms had one yield for crop insurance and another for the agricultural-conservation program.

APPRAISAL OF THE 1939 PROGRAM

Naturally a single and as yet incomplete year of operation has not made possible detailed studies of the effects of the crop-insurance program. However, it has been possible to draw certain broad conclusions as to progress made toward the major objectives of the program, as follows:

(1) In its first year, the wheat-crop-insurance program has accomplished its principal purpose of demonstrating the possibilities of an all-risk insurance program for wheat. Participation has been sufficiently extensive and varied to provide a Nation-wide test of the program.

(2) The basic principles have been found to be practicable. In improving the program for 1940 operation, it was found unnecessary to make any amendments which would modify the basic principles of insurance underlying the program, such as calculation of yields and rates on the basis of past experience of each farm, of carrying the

insurance reserve in actual grain in storage, and of limiting the insurance to a maximum of 75 percent of the average yield.

(3) While it will require continued analysis and correction for a number of years to refine the actuarial data, it appears that they provide a workable basis for wheat-crop insurance. The records accumulated in 1939 and to be accumulated in subsequent years will develop a more complete knowledge than has existed regarding the actual risks of growing wheat on individual farms. It is felt that the technique of assembling and applying actuarial information has been developed to a point where it is entirely workable and that methods so developed may be the basis for assembling and applying actuarial data if they should be required for crops other than wheat.

(4) To make insurance available to practically all wheat producers and to have a wide geographical distribution of risks, the program has been presented in all except a few very minor wheat-producing areas. The cost of operation under this plan is somewhat higher than it would be if limited to the major wheat areas. It is felt that an amount of participation, double or triple that in 1939, can be handled without exceeding the present appropriation available for administration.

It should be considered that during the first year the Corporation carried, in addition to the usual current operating expenses, a number of expenses which in commercial practice would be amortized over a long-time period as capital and development expense. Included in this expense were such items as the organization of a new program, original research, and development of basic actuarial material, training of personnel, purchase of equipment, and informational and educational programs to introduce the idea of crop insurance. In addition, part of the appropriation was used for extensive research as to the possibilities of crop insurance for other crops such as cotton and corn. Because of this capital investment in crop insurance, the expenditures of the Federal Crop Insurance Corporation in the 1939 program cannot be compared directly with the 1939 participation secured. Cost of administration of the program per farmer insured can best be reduced by increasing the participation, and it is believed that the development work undertaken in 1939 and the demonstration of the 1939 program will increase the participation materially in future years.

IMPROVEMENT OF 1940 PROGRAM

The experience gained in the 1939 program has made it possible to introduce many improvements in the 1940 program which should result in greater economy of operation, greater participation, and more effective application of the basic crop-insurance principles.

THE 1940 ACTUARIAL APPROACH

The actuarial plans devised for the 1940 program were an attempt to meet some of the problems that were brought to light in the 1939 program. To improve the timing of the work so that premiums could be collected at the time the application was accepted in the county office, plans were made to set up yields and rates on listing sheets in advance of the application period.

The experiences of the first year indicated that the Corporation should recognize that the appraisal of yields and rates was the major, rather than the minor, method of determining the basis for insurance. The plan developed in the 1939 program of using key farms for appraisal purposes was adopted as the keystone of the yield and rate structure for 1940.

Three types of listing sheets were prepared: (1) One for key farms, based primarily on historical records of annual yields; (2) one for other farms for which historical records of annual yields would be used as the basis for applications for insurance; and (3) one for farms on which average yields and premium rates would be appraised. The key-farm listing sheets were prepared first. The yields and premium rates were computed on separate work sheets by the same method of computation as was used in the 1939 program. The data for the key farms, when ready, were submitted through the State offices to the branch offices for approval. Average yields and premium rates for other farms for which annual yields were submitted on a historical basis were prepared in the same manner and transmitted to the branch office. There were relatively few such listing sheets. After the key-farm listing sheets were approved, county offices appraised yields and rates for all allotment farms in the major wheat counties, using the key farms as the basis for appraisal. These were to be transmitted through the State offices to the branch offices for approval.

In the 1939 program the basis for insurance was the 6-year period 1930–35, for which individual farm records were obtained, adjusted to the 10-year period 1926–35. For the 1940 program, the years 1936, 1937, and 1938 have been included, using the 13-year period as the basis for writing insurance. In the Great Plains region, where extreme droughts have occurred in the base period, the 13 years were extended by an adjustment factor to reflect the experience for the 20-year period 1919–38.

ONE OPERATION

To obtain insurance in 1940, the grower simply fills out an application with information as to intended plantings for 1940. The yield and rate for his farm are already known. The premium is payable at the time the application is signed and may be paid by: (1) Delivering a warehouse receipt for wheat equivalent in value to the amount of wheat specified in his application; (2) paying in cash the equivalent of the amount of wheat specified as the premium at the current market price; or (3) authorizing an advance against future payments to be earned under the A. A. A. programs. Premiums must be paid at the time the application is signed. After the grower has paid his premium, nothing further is required of him, except to report the actual acreage seeded, and to notify his local committee in case of damage to an insured crop.

NO FORMAL INSURANCE POLICY

The insurance contract will consist of the application, the acceptance of the application by the Corporation, and the regulations relating to the 1940 program.

APPLICATIONS MUST BE MADE BEFORE PLANTING

Applications will be accepted only prior to the planting of the crop to be insured. Dead lines will be set for various areas with respect to the last date on which applications may be received in the county offices. Growers may apply up to the date of the dead line, or to the planting of their crop, whichever is earlier. This restriction has been made to assure that there will be no opportunity to insure a crop after it gets off to a poor start, thus placing both the Corporation and the individual grower on the same ground with respect to knowledge of the prospects of the crop to be insured.

EQUIVALENTS WILL BE COMPUTED IN COUNTIES

It was found feasible to compute the cash equivalents of premium payments in counties rather than in the branch offices, thus making it possible to rule out a certain amount of delay, correspondence, and extra forms involved in transmitting applications to branch offices for determining the premium due. Pricing schedules will be furnished to county offices regularly for computation of cash equivalents.

IMPROVED PRACTICES RECOGNIZED

It was found that an average yield based on past history of the farm did not take into account recent improvements in methods of farming in some areas, such as irrigation and summer fallowing, which have been found to increase the average yields and to decrease the amount of risk involved. In order to give due weight to the use of these special practices, the Corporation has adopted a special-practice procedure under which the effect of certain improved methods in certain areas may be measured and the possibility of higher yields and reduced risks given due weight in determining the insurable yields and premium rates for farms on which such practices are used.

As a result of these and other improvements it is felt that it will be possible to conduct the 1940 program with greater accuracy, with fewer forms, and with less work and expense per insured farm.

NEED FOR FURTHER RESEARCH

The experience of 1939 points the way to the need for and the possibility of certain detailed studies which should be undertaken in order that scientific data may be accumulated to measure the potentialities of the principles of crop insurance. Some of the studies that should be considered are:

(1) *Analysis of production methods and their incidence on insurance yields and premium rates.*—As the program now operates, it relies largely on the past history of yields and losses during a base period. Undoubtedly this is a good way to measure variations caused by changing weather conditions reflecting the effect of natural hazards. However, producers may increase yields and reduce hazards by use of new varieties of wheat that are resistant to certain natural hazards, by the use of improved types of machinery which increase the possibilities of timeliness in performing certain farming operations, and the use of new methods of cultivation and other factors which have an effect on yields and, consequently, on crop insurance.

The Corporation has considered certain improved types of farming such as irrigation and summer-fallow in the establishment of insurable yields and premium rates. However, more data are needed to measure accurately the actual effect of these various production methods on the risk of growing wheat on individual farms. It can be seen that the development of applicable information along this line, tied in with insurance, may prove to be a powerful stimulus toward the adoption of better farming methods since through crop insurance the grower is guaranteed that he will receive at least a substantial part of a reward for improved methods.

(2) *Analysis of losses and methods of adjustment of losses.*—The Corporation should undertake an operative study of adjustment of losses to improve its present methods of adjustment and to discover any lack of uniformity of determining salvage, cause of loss, etc. It would seem highly important that each loss be analyzed in order that the Corporation may set up definite standards of adjustment and may assemble useful information regarding the frequency of various causes of loss, the effect of various hazards, and methods for keeping such losses at a minimum. It is entirely possible that, because of its opportunity to accumulate a large amount of data as to causes of loss on individual farms all over the United States, the Corporation may be able to produce valuable information on the effect of a number of the Department's programs for improvement of farming methods and may also be able to show the way in which the cost of crop failure can be reduced for wheat farmers in general.

(3) *Analysis of the most economical form of capital reserve.*—It was apparent at the time the basic plan of crop insurance was drawn up that the wheat reserve accumulated through payment of premiums would fluctuate considerably from year to year, increasing in good crop years, when premiums collected would exceed indemnity requirements, and decreasing in poor crop years, when premiums would be less than requirements for indemnities. To balance the wheat reserve, the Corporation was provided with an initial capital fund of $20,000,000 on the theory that this fund could be used to pay losses if they occurred before an adequate reserve was built up from premiums. However, it is probable that those years in which the capital funds are required to pay losses will be years of generally poor crops, with a tendency toward higher prices. Consequently, a capital solely in the form of dollars might suffer to some extent from price changes; that is, it might require more money to buy the necessary wheat than it would if bought at the time premiums were paid. It has been suggested that the Corporation might to some extent protect its capital against such a contingency by investing a portion of it in actual wheat in storage to maintain capital in the same form that would be required for indemnity payments.

It is believed that an exhaustive study should be made to develop facts regarding the most economical form of capital funds, which would aid in establishing and maintaining a definite long-time policy in this respect.

(4) *Evaluation of insurable yields and premium rates in connection with developing conditions.*—Since the actuarial basis of the program draws from past experience, there exists a possibility that such rates as may be established may not be correlated with changing conditions or may not coordinate with the aims and purposes of other

national farm programs. For example, continuance of present rates in some areas might tend to subsidize production of wheat on marginal lands, thus working against the interests of programs that are designed to retire such lands from uneconomical production. It is possible, also, that the crop-insurance program might tend to "freeze" wheat production at figures not in accord with a good national policy. The Corporation might well give due consideration to the effect of insurance on new conditions to aid in developing policies correlating the program more closely with other land-use and adjustment programs.

5. *Forecasting losses and yields prior to occurrence.*—It is very important to the Corporation that it be apprized of probable losses at the earliest possible date in the growing season, since such information will assist the agency to locate its reserves with a view to the most economical distribution of indemnities and to locate personnel properly to handle this phase of the program. The experience of the past year indicates that there is definite need for forecasts of probable losses to keep the officers of the Corporation sufficiently informed to maintain the most effective organization. A number of studies along this line are being made by several agencies of the Department of Agriculture and by various State experiment stations and colleges. The Corporation should assemble such information as these projects develop and coordinate it as the basis of a system for forecasting losses applicable to its needs.

6. *Study of effect of crop insurance on wheat income.*—Tentative research has indicated that the stabilization of growers' wheat production will actually result in an appreciable net increase in the buying power of wheat growers. This is important from the standpoint of educating wheat growers and the general public to the advantages of crop insurance. Information regarding this aspect of crop insurance is as yet fragmentary and tentative. A uniform long-time study based on actual income experience should be organized in the principal wheat States.

FINANCIAL REPORT

Under Public, No. 644, Seventy-fifth Congress, Department of Agriculture Appropriation Act, 1939, approved June 16, 1938, funds not to exceed $20,000,000 of the unobligated balance of the appropriation made in the Department of Agriculture Appropriation Act, 1938, approved June 29, 1937, under the head of "Conservation and Use of Agriculture Land Resources, Department of Agriculture" were made available for use by the Secretary of the Treasury during the fiscal year 1939, at such times and in such amounts as the Secretary of Agriculture may request, for the purpose of subscribing to and paying for the capital stock of the Federal Crop Insurance Corporation of the United States of America, as provided for in section 504 of the Federal Crop Insurance Act, approved February 16, 1938. The payment of said stock by the Secretary of the Treasury shall, with the approval of the Secretary of Agriculture, be subject to call in whole or in part by the board of directors of the Federal Crop Insurance Corporation, and shall be effected by transfer of funds on the books of the Treasury Department to the credit of the Corporation, the funds so transferred to be subject to requisi-

tion by the Corporation with the approval of the Secretary of Agriculture.

The Federal Crop Insurance Act, as amended, section 510, states:

> All money of the Corporation not otherwise employed may be deposited with the Treasurer of the United States or in any bank approved by the Secretary of the Treasury, subject to withdrawal by the Corporation at any time, or with the approval of the Secretary of the Treasury may be invested in obligations of the United States or in obligations guaranteed as to principal and interest by the United States.

During the fiscal year ended June 30, 1939, $10,000,000 of the subscription to the capital stock was called and deposited with the Treasurer of the United States to the credit of the Federal Crop Insurance Corporation. This fund is being used as a revolving working fund in carrying out the operations of the Federal Crop Insurance Corporation.

The revolving working fund is being used for a twofold purpose: (1) To permit the purchase of wheat simultaneously with the collection of premiums, and (2) to allow the Corporation to purchase in approved storage facilities, bushel for bushel, the quantity of wheat represented as premiums in terms of bushels for the Corporation's insurance contracts. Because the wheat reserve is in balance, in terms of wheat, with premium collections, the Corporation avoids almost entirely the possibility of the gain or loss through the price changes in the market value of wheat.

No call has been made on the Secretary of the Treasury for the balance of the subscription to the capital stock amounting to $10,000,000. This is based on the theory that: Since the Federal Crop Insurance Corporation is wholly a Government-owned corporation, there would be no advantage gained under the current fiscal position of the Government, by investing this $10,000,000 in obligations of the United States; and since the administrative and operating expenses of the Corporation are paid out of monies appropriated annually by Congress, the Corporation does not need the interest which would accrue to it from such investments. It should be remembered that the indemnities for crop losses are to be borne out of the insurance premiums paid by the insured and that the necessity for using capital funds to meet indemnity payments will only arise in those years when crop conditions are such as to make indemnity payments exceed premium collections.

The administrative and operating expenses of the Corporation are paid from money appropriated by Congress for that purpose. The accounting records for these funds are maintained along the lines of the regular governmental encumbrance system prescribed by the General Accounting Office.

A double-entry accounting system has been installed to record the insurance operations. The accounts reflect both the recordation of the cash transactions and the wheat transactions. This double recording is necessary because of the fact that the Federal Crop Insurance Act authorized the Corporation to accept premiums either in wheat or the cash equivalent thereof and to pay indemnities either in wheat or the cash equivalent thereof.

The situation of the Corporation as of June 30, 1939, is summarized in the following reports: Balance sheet; administrative expenses (table 4); insurance reserve—wheat; wheat in store; wheat-purchase commitments (table 5); wheat-sales commitments (table 6);

operating reserve; premium payments, insured acreage, and insured production (table 7); and indemnity payments (table 8).

BALANCE SHEET AS OF JUNE 30, 1939

Assets

Cash:	
With Treasurer of United States:	
Grain account	$7,294,714.39
Premiums and other receipts	829,905.37
On hand and in banks	136,626.74
Total	8,261,246.50
Capital fund—unrequisitioned from United States Treasury	10,000,000.00
Accounts and other receivables:	
Due from completed sales of wheat	12,892.75
Due from uncompleted sales of wheat	39,562.50
Miscellaneous	211.75
Total	52,667.00
Other assets:	
Wheat inventory:	
In store (stated at cost value)	4,215,215.30
In transit (purchase commitments)	107,317.83
Total	4,322,533.13
Deduct:	
Sales commitments	39,562.50
Net inventory	4,282,970.63
Refundable inbound switching	1,140.68
Total	4,284,111.31
Total assets other than interagency	22,598,024.81
Interagency assets:	
Due from governmental corporations or agencies:	
Agricultural Adjustment Administration A. C. P. advances	671,024.66
Farm Security Administration	3,994.17
Total	675,018.83
Total assets	23,273,043.64

Liabilities

Other liabilities:	
Accounts payable:	
Wheat purchases	107,317.83
Miscellaneous	1,825.73
Total	109,143.56
Reserves:	
Operating reserve	3,163,900.08
Total liabilities	3,273,043.64
Capital	20,000,000.00
Total liabilities and capital	23,273,043.64

NOTE.—The policies issued or to be issued by the Corporation number 165,271, with an insured production of 62,748,101 bushels. Actuarially, it is estimated that the contingent liability of the Corporation to cover loss will not exceed 10 percent of the insured production; however, the actual liability for any year might be greater or less than the actuarial estimate of the contingent liability.

TABLE 4.—*Administrative expenses for the fiscal years ended June 30, 1938 and 1939*

Item	For the fiscal year ended—		Total
	June 30, 1938	June 30, 1939	
Personal services	$41,576.31	$1,254,199.77	$1,295,776.08
Supplies and materials	38,994.79	87,578.70	126,573.49
Communication service	1,491.65	19,599.92	21,091.57
Travel expense	14,857.85	55,525.86	70,383.71
Transportation of things (service)	893.64	11,422.71	12,316.35
Printing and binding	29,289.19	67,759.02	97,048.21
Advertising and publication of notices		114.59	114.59
Heat, light, power, water, electricity, etc	13.31	330.09	343.40
Rent	1,658.38	45,204.60	46,862.98
Repairs and alterations	419.02	350.38	769.40
Special and miscellaneous current expenses:			
Administrative expense of local associations, A. A. A.		1,175,000.00	1,175,000.00
Storage		340,056.63	340,056.63
Miscellaneous	2,483.31	30,874.31	33,357.62
Equipment	87,637.54	85,279.22	172,916.76
Total	219,314.99	3,173,295.80	3,392,610.79
Budget reserve		20,000.00	20,000.00
Amount reserved for transfer to other departments		120,000.00	120,000.00
Reallotted:			
Office of the Secretary		42,500.00	42,500.00
Office of the Solicitor	15,968.00	58,690.00	74,658.00
Bureau of Agricultural Economics		78,000.00	78,000.00
Agricultural Adjustment Administration		480,000.00	480,000.00
Administrative expense of local associations, A. A. A.		1,000,000.00	1,000,000.00
Total	235,282.99	4,972,485.80	5,207,768.79
Unencumbered balance	729,717.01	527,514.20	1,257,231.21
Grand total	965,000.00	5,500,000.00	6,465,000.00

INSURANCE RESERVE: WHEAT, FROM JULY 1, 1938, TO JUNE 30, 1939

	Bushels
Net premium bushels collected, including deposits (table 7)	6,822,956
Less indemnities paid (table 8)	791,513
	6,031,443
Deposits for 1940 premiums deducted from indemnities paid	6,928
Net insurance reserve, wheat as at June 30, 1939	6,024,515
Represented by:	
Purchases wheat, completed	7,227,835
Deduct: Sales of wheat, completed	1,203,760
Wheat in store (schedule 1)	6,024,075
Add: Purchases in transit (table 5)	132,163
	6,156,238
Deduct: Sales uncompleted (table 6)	55,000
Inventory as at June 30, 1939	6,101,238

The Corporation shows, as of June 30, 1939, a long wheat position of 76,723 bushels, 16 pounds. The long and short wheat position of the Corporation changes from day to day as more premiums are being reported and collected, and as indemnities are being paid.

WHEAT IN STORE AS OF JUNE 30, 1939

(Schedule 1)

	Bushels
Hard Red Winter	2,016,302
Soft Red Winter	176,987
Dark Hard Red Winter	141,500
Hard Amber Durum	396,000
Dark Northern Spring	2,962,585
Heavy Dark Northern Spring	208,657
Soft White	66,836
Western White	24,264
Hard White	30,945
Total wheat inventory	6,024,075

TABLE 5.—*Wheat-purchase commitments as of June 30, 1939*

Purchase contract No.	Vendor	Quantity	Grade	Amount
		Bushels		
M-236	Commodity Credit Corporation.	17,101	No. 1 Hard White	$14,365.06
M-243	Farmers Union Grain Terminal Association.	1,343	No. 1 Heavy Dark Northern Spring.	1,124.76
M-242	do	65,000	No. 1 Dark Northern Spring.	56,375.00
M-245	Commodity Credit Corporation.	5,966	do	4,846.98
	Total	70,966		61,221.98
M-246	Farmers Union Grain Terminal Association.	10,000	No. 2 Hard Amber Durum	6,875.00
M-247	Cargill, Inc	25,000	No. 2 Hard Amber Durum	17,838.75
	Total	35,000		24,713.75
S-27	Commodity Credit Corporation	7,753	No. 2 Soft White	5,892.28
	Total	132,163		107,317.83

TABLE 6.—*Wheat-sales commitments as of June 30, 1939*

Sales contract No.	Vendee	Quantity	Grade	Amount
		Bushels		
KC-101	Public Terminal Elevator Co.	25,000	No. 2 Hard White	$16,875.00
KC-105	Producers Grain Corporation	10,000	do	8,012.50
KC-106	Nebraska Consolidated Mills	10,000	No. 3 Hard White	6,700.00
KC-107	Garrison Milling Co	10,000	No. 2 Hard White	7,975.00
	Total	55,000		39,562.50

OPERATING RESERVE FROM JULY 1, 1938, TO JUNE 30, 1939

Net premiums paid and accrued (cash equivalent, including deposits)		$3,528,440.55
Proceeds from sale of warehouse receipts paying premiums		4,623.46
Net proceeds from sale of wheat:		
Sales price	$862,226.31	
Less cost of sales	774,426.63	
		87,799.68
		3,620,863.69
Deduct indemnities paid (cash equivalent)		456,963.61
Total operating reserve		3,163,900.08

As the premiums for the insurance coverage have been collected on the basis of bushels of wheat and the indemnities are and will be computed and paid on the basis of bushels of wheat, the above operating reserve does not represent the insurance reserve, which is set forth on a separate schedule (p. 26). This reserve represents a balancing element between the cash equivalent of the wheat collected, purchased, sold, and paid out in indemnities.

TABLE 7.—*Premium payments, insured acreage, and insured production for principal classes of wheat grown by States as of June 30, 1939*

Class of wheat and State	Policies [1]	Premium payments received [2]	Wheat acreage insured [3] [4]	Total insured production
Soft red winter:	*Number*	*Bushels*	*Acres*	*Bushels*
New York	652	5,194	8,769	150,106
Pennsylvania	2,301	16,599	30,432	448,927
New Jersey	29	190	380	5,778
Delaware	79	874	1,761	22,145
Maryland	986	11,288	23,055	291,430
Virginia	916	7,843	15,384	189,240
West Virginia	1	18	37	402
Michigan [5]	5,072	31,997	52,310	774,148
Ohio	10,314	136,548	131,078	1,807,177
Indiana	11,185	145,435	168,864	2,063,010
Illinois	12,227	187,012	275,515	2,950,640
Missouri	15,846	200,929	365,986	3,335,340
Total	59,608	743,927	1,073,571	12,038,343
Hard red winter:				
Iowa	4,675	57,998	75,918	913,410
Nebraska	13,350	507,693	447,822	4,166,911
Kansas	15,017	778,352	892,682	7,520,983
Oklahoma	8,695	280,566	484,363	4,065,238
Texas	3,691	397,167	355,312	2,543,280
Wyoming	322	29,947	24,137	214,410
Colorado	1,443	78,364	72,166	585,842
New Mexico	111	13,644	9,362	81,724
Utah	454	23,039	33,631	523,863
Total	47,758	2,166,770	2,395,393	20,615,661
Hard red spring and durum:				
Wisconsin	184	1,352	1,544	16,836
Minnesota	10,529	199,678	309,677	2,644,913
North Dakota	27,093	1,994,192	2,168,134	12,663,104
South Dakota	10,035	695,643	503,755	2,679,764
Montana	5,253	708,382	555,381	4,499,954
Total	53,094	3,599,247	3,538,491	22,504,571
White:				
Nevada	34	525	667	13,121
Idaho	1,727	81,440	135,998	2,150,260
Washington	1,366	91,728	182,751	2,428,914
Oregon	679	64,818	96,365	1,420,294
California	1,005	74,501	112,903	1,576,937
Total	4,811	313,012	528,684	7,589,526
Grand total	165,271	6,822,956	7,536,139	62,748,101

[1] The number of policies includes those issued and those to be issued on which premiums have been paid.
[2] Represents wheat premiums whether received as wheat or as the cash equivalent.
[3] Includes acreage of farms for which only the landlord's share or the tenant's share of the crop is insured.
[4] Subject to final determination of acreage seeded.
[5] Soft red winter wheat grown but not the principal class.

TABLE 8.—*Indemnity payments by States, as of June 30, 1939*

State	Indemnities paid	Quantity	Amount	State	Indemnities paid	Quantity	Amount
	Number	*Bushels*	*Dollars*		*Number*	*Bushels*	*Dollars*
California	45	55,729	37,806.43	Ohio	41	6,050	4,394.51
Colorado	32	8,782	4,214.62	Oklahoma	385	68,994	39,372.99
Illinois	30	7,523	5,123.53	South Dakota	22	11,721	7,465.92
Indiana	30	5,620	4,081.92	Texas	1,033	438,494	249,013.34
Iowa	34	3,633	2,028.84	Virginia	1	958	814.30
Kansas	245	94,258	53,013.61	Washington	3	848	423.23
Michigan	9	643	443.63	Wisconsin	9	660	430.52
Minnesota	7	625	429.62	Wyoming	3	398	189.17
Missouri	14	1,614	981.44				
Nebraska	529	83,352	45,911.16	Total	2,473	791,513	456,963.61
New Mexico	1	1,611	824.83				

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UNITED STATES DEPARTMENT OF AGRICULTURE
FEDERAL SURPLUS COMMODITIES CORPORATION
WASHINGTON, D. C.

REPORT

OF

FEDERAL SURPLUS COMMODITIES CORPORATION

FOR THE

FISCAL YEAR 1939

ISSUED October 31, 1939

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON: 1939

FEDERAL SURPLUS COMMODITIES CORPORATION

A nonprofit, membership corporation without capital stock, organized October 4, 1933, under the laws of Delaware as the Federal Surplus Relief Corporation. Name changed November 18, 1935.

MEMBERS OF THE CORPORATION

The Secretary of Agriculture of the United States, the Under Secretary of Agriculture, and the Assistant Secretary of Agriculture.

BOARD OF DIRECTORS

H. A. Wallace
M. L. Wilson — A. G. Black
H. L. Brown — Milo Perkins

OFFICERS

Milo Perkins, President
Philip F. Maguire, Vice President
E. W. Gaumnitz, Vice President
F. A. Silcox, Vice President
Earl J. Smith, Secretary
Gordon P. Peyton, Assistant Secretary
W. B. Robertson, Treasurer

REPORT OF

THE FEDERAL SURPLUS COMMODITIES CORPORATION

FOR THE

FISCAL YEAR 1939

During the fiscal year 1939, the Federal Surplus Commodities Corporation expanded substantially its agricultural surplus removal programs. These programs are designed to encourage increased consumption of farm products, particularly by low-income groups, thus aiding both producers and consumers.

At the same time that it increased its direct purchase and distribution program, the Corporation developed two additional methods for attaining its objectives. These were the wheat-export program and the food order stamp plan.

The development of the food stamp plan grew out of the search for still more effective ways of expanding the domestic market for the American farmer and combatting malnutrition among millions of American families. Under this plan farm surpluses are moved through regular commercial channels by increasing the buying power of low-income consumers to enable them to secure these foods. The increased buying power is in the form of surplus food order stamps which may be used in any grocery store to obtain foods which have been listed as surplus.

The plan was inaugurated late in the fiscal year and was operating experimentally in two cities, Rochester, N. Y., and Dayton, Ohio, at the close of the year. It was demonstrated in these two cities, however, that the mechanics of the stamp plan worked smoothly and that further expansion was justified. Another stamp plan city, Seattle, Wash., was selected before the end of the year, and plans were made for the selection of three more experimental cities. Studies of the movement of the surplus items in the two cities indicate that with the extension of the stamp plan to a number of cities, an important new market will be created for many of these items and a major step will be taken toward overcoming the problem of malnutrition.

The wheat export program was adopted to move surplus wheat and to assist our farmers in maintaining their fair share of the world market. Under this program domestic wheat was bought by the Corporation at the price prevailing in this country and sold to exporters at a price which enabled them to sell on the world market. The program operated in close conjunction with the flour export program of the Department of Agriculture. Together the two programs assisted in moving 94 of the 118 million bushels of wheat exported during the fiscal year.

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Under the direct purchase and distribution method of operation, nearly 2 billion pounds of surplus farm commodities were bought at an approximate cost of $66,500,000. Purchases were made of nearly 40 different surplus agricultural commodities including dairy and poultry products, fruits and vegetables, and flour and cereals. Some 3 million families, nearly 11 million people a month in all States, the District of Columbia, Puerto Rico, and the Virgin Islands received these commodities.

In addition to its other activities, the Corporation cooperated with the Forest Service in carrying out the programs of the Northeastern Timber Salvage Administration.

The programs of the Corporation are conducted under authority established by Congress in clause 2 of section 32, Public, No. 320, approved August 24, 1935, as an amendment to the Agricultural Adjustment Act. This legislation makes available to the Secretary of Agriculture a sum equal to 30 percent of the gross customs receipts for the previous year, which may be used to increase domestic consumption by diverting agricultural commodities from the normal channels of trade, by increasing their use among low-income families, or by encouraging their export. Public, No. 430 (75th Cong.) approved on February 16, 1938, extended the life of the Corporation until June 30, 1942.

CORPORATION ACTIVITIES PART OF GENERAL FARM PROGRAM

The surplus removal programs, including direct purchase and distribution, the stamp plan, and the export program, are an integral part of the Farm Program of the Department of Agriculture. Surplus removal operations supplement the adjustment, conservation, and ever-normal granary provisions of the general program, and act to stabilize marketing conditions for producers and to expand domestic and export markets.

Domestic surplus removal programs have been most active and most effective among such commodities as dairy and poultry products, and fruits and vegetables. These commodities have not been so directly affected by the adjustment and conservation programs. Further, many of them are commodities for which the consumption is elastic. Consumption of these commodities has been restricted by low-consumer income, despite the fact that fruits and vegetables, and dairy and poultry products are protective foods essential in preventing malnutrition.

Surplus removal programs apply the supply and price stabilization principles of the ever-normal granary to the perishable and semiperishable fruits and vegetables, and to dairy and poultry products. By moving these foods into immediate consumption, waste of perishables and the accumulation of excessive supplies of semiperishables are prevented.

DIRECT PURCHASE AND DISTRIBUTION PROGRAMS

The surpluses involved in the programs may be temporary and local, such as those caused by the absence of buyers in a commercially important producing area; they may be seasonal, as when unusual

weather conditions cause the marketing season of normally noncompetitive areas to overlap; or they may be of a character requiring readjustment over a long period of time as a result of shifts in consumer demand or loss of foreign markets.

As a supplement to other efforts, purchase programs provide a means to improve marketing conditions. This involves aiding in the establishment of orderly marketing and improved grading and packing standards. These programs also have helped to bring about the necessary readjustments caused by too optimistic acreage expansion. The surplus removal operations, however, are not designed to encourage uneconomic methods of production or marketing, or the sale of varieties and grades that no longer meet commercial requirements.

Through the programs an effort is made to prevent the physical and economic wastes that take place when growers of perishable commodities are forced to market all of their supplies in a very short time or when unusually heavy supplies of semiperishable commodities, carried over from previous seasons, cause large quantities of the latest crop to go unharvested. Assistance is rendered by purchasing part of the excessive supplies, thus reclaiming for human consumption surplus commodities which might otherwise be wasted.

Purchases of surplus agricultural commodities are made at the direction of the Secretary of Agriculture, following a determination that a surplus condition exists and that a purchase program will aid in correcting the situation. Following a request for assistance from growers or groups of growers, an investigation is made by the Division of Marketing and Marketing Agreements of the Department of Agriculture. The investigation will determine whether supplies are large and burdensome and whether prices received by producers compare unfavorably with those of previous seasons. If such a condition is found to exist, the result of the Division's investigations are sent to the Secretary in the form of recommendations. These set forth definite information that a surplus of a specific commodity exists; that a purchase program would assist in alleviating the situation; that the surplus includes definite types and grades of the commodity; that the surplus exists in a certain defined area; and they suggest maximum prices to be paid and the maximum quantities to be purchased. If the Secretary determines that the recommended purchase is justified, the Corporation is authorized to carry out the program in accordance with his directions.

In conducting a purchase program, the primary aim is to improve returns to producers for their entire crop rather than to improve returns only to the extent of the buying operations. The removal of that portion of the supply which most seriously depresses the market, helps make possible maximum commercial utilization of the crop. The amount which is bought through a surplus-removal program usually represents a very small part of the production or available supply of the commodity. For the most part, it is between 1 and 5 percent of the total; occasionally it is higher. In some instances, however, merely an announcement of the intention to buy brings about an immediate improvement in the market price situation.

A constant effort is made to see that the results of purchase programs are not confined to a small number of producers, but that they aid the entire group marketing the commodity. Purchases ordinarily are conducted in areas producing in sufficient quantities to affect

marketing conditions and prices, or if this is not practical administratively, they are conducted in the central markets which establish market prices.

Programs conducted by the Corporation, furthermore, are an attempt to assist industry groups in recognizing the advantages of cooperative action in meeting their marketing problems. The experience of industry advisory committees of growers and handlers, which are set up to assist with purchase programs, has encouraged growers to continue their efforts toward cooperative action and sometimes to formulate marketing-agreement programs to bring about orderly marketing of their commodities.

Farmers market purchase program.

Buying surpluses of fresh vegetables from farmers' markets was a new and interesting development in the direct purchase operations during the past fiscal year. These markets are located in or near large cities, and local producers of truck crops for the cities sell their crops at these markets. During the summer of 1938 there was a sharp increase in commercial truck crops, that is, truck crops raised on a large scale at distant points and shipped to cities. The production of locally grown truck crops is not officially estimated, but indications are that it also increased materially. Because of the large supplies flowing into the cities from the two sources, prices being received by local producers in the farmers' markets in July 1938 were only one-quarter to one-third of the 1933–37 average for July. During the summer of 1938 purchases were made in 30 farmers' markets located in Connecticut, Massachusetts, New York, New Jersey, Pennsylvania, Ohio, Michigan, and Minnesota. The Corporation bought at prices closely following the market and attempted to absorb the quantity in excess of the daily market requirements.

In addition, efforts were directed toward bringing about a permanent improvement in the grading, packing, and packaging of locally grown produce. In this way the program sought to overcome the handicap which local produce had suffered because of the higher quality and packing of produce from the commercial producing centers. Accordingly, the Corporation required that all vegetables it bought must meet grade requirements. Free inspection service was supplied as a further inducement. As a result of this program, and the efforts of cooperating agencies, much improvement in grading and packaging, as well as some standardization of containers, was reported in a number of the markets. In all, approximately 556,000 bushels of eight commodities, principally snap beans, beets, cabbage, carrots, celery, and tomatoes, were purchased at a total cost of $295,700.

Fluid milk purchase program.

Another important development in the direct-purchase program was the purchase of fluid milk in the greater Boston milk marketing area, begun in October of 1937, and continued through the fiscal year of 1939. At the time this program began, about 50 percent of the milk produced for sale in the Boston market was classified as surplus milk and did not go into fluid-milk channels. For this surplus milk the producer received, on an average, less than one-half as much as for milk sold as bottled milk.

At the same time, a study of the milk-buying habits of 18,000 Boston relief families showed that 49 percent were buying no milk and

that the average bought by all the families was less than 3 pints a week.

The fluid milk purchase program was developed to encourage increased consumption of milk among the needy and to improve returns to producers by making use of supplies of surplus milk which otherwise would have been utilized for manufacturing purposes. The program supplemented operations under the Federal order regulating the handling of milk in the Boston marketing area.

Municipalities agreed to provide funds through the Massachusetts Department of Public Welfare for processing and delivery of milk in quart bottles to distributing stations set up and supervised by the Commodities Division of the Welfare Department, for families receiving public assistance. Any municipality included in the Greater Boston Marketing Area was permitted to participate if it desired. Milk was also supplied to the New Hampshire Department of Public Welfare for distribution in Manchester, N. H., under a similar arrangement. Allotments to individual families were controlled by the commodity distribution division in accordance with size of family and the total amount of milk available.

In order to prevent the relief milk from replacing commercial purchases, each recipient was required to fill out and sign a card certifying the amount of milk then being purchased, from whom the purchases were made, and other data, and stating that such purchases would be continued during the period of relief distribution.

The program started on October 14, 1937, with delivery of 20,000 quarts to 37 distributing stations in Boston proper. Deliveries were increased rapidly as suburban stations were ready for operations. By the end of November, 28 suburban cities and Manchester, N. H., were being supplied. An average of 87,000 quarts per day was being distributed by May 1938. Purchases continued at approximately that level until October 1938, when the need for additional purchases arose.

W. P. A. workers had a higher cash income than persons receiving direct relief. Consequently, in October 1938, an experiment was conducted by which persons on W. P. A. projects were permitted to obtain milk by paying the cost of processing and delivery. The cities were paying processing costs on milk received by those on direct relief. Families on direct relief were permitted to take 1 quart above their free allotment by paying this processing cost. It is interesting to note that more than 10,000 families on direct relief and receiving free milk paid for this processing in order to obtain additional milk.

From October 1938, distribution increased from 87,000 quarts per day to a peak of 127,000 quarts per day during the last half of December. In January, due to more stable marketing conditions which brought about a more equitable distribution of surplus among producers, the purchases were reduced to 70,000 quarts per day, at which level purchases continued to the end of the fiscal year on June 30, 1939.

The average rate of distribution was 32.6 quarts per family per month. The average size of family was 4.5 persons. Approximately 40 million quarts were distributed from October 1937 to June 1939, at a cost of about $2,800,000.

Extent of Purchases.

During the past fiscal year commodity expenditures totaled about $66,500,000, an increase of nearly one-third over the 1937–38 total. In all, 38 surplus agricultural commodities were purchased for relief distribution, and in volume these purchases represented more than 50,500 carloads. Butter accounted for 52 percent of the expenditure; white and graham flour, whole wheat cereal, and corn meal were 13 percent of the total; grapefruit and grapefruit juice were nearly 8 percent; fluid milk 5 percent; oranges, 4 percent; dry beans, 3 percent; cotton products, 2 percent; Irish potatoes, 2 percent and cabbage nearly 2 percent. Expenditure for raisins, miscellaneous truck crop programs, and eggs were each about 1 percent of the total. These items accounted for about 95 percent of the total expenditure.

The purchases were made in all parts of the United States. Temporary field offices were established in 89 towns and cities throughout the country to conduct these purchases.

Distribution of surplus commodities.

In carrying out the provisions of the authorizing legislation, the Corporation distributes the surplus products through State welfare agencies which maintain a commodity-distribution system in each State. However, certain basic rules are laid down by the Corporation to guide the State welfare agencies in distributing surplus commodities to eligible low-income families. The first is that only persons who have been certified to be in need of public assistance are entitled to receive surplus commodities. Second, surplus commodities are given in addition to any other form of aid. This prevents the already limited purchasing power of these low-income families from being reduced by the value of the commodities received. The third rule is that commodities are not to be distributed in quantities in excess of the maximum rates set by the Corporation. These maximum rates have been carefully developed with the cooperation of the Bureau of Home Economics, and seek to supply the difference between what the family can buy and what they should have to satisfy their diet needs.

During the fiscal year ended June 30, 1939, a total of 1,970,000,000 pounds of foodstuffs were distributed to the States. The commodities went to an average of 10,500,000 people each month. The bulk of this distribution was to families on relief whose relief grants were insufficient to provide an adequate diet. Surplus commodities are not intended to supplant regular relief allowances, but rather to increase the total food supply of these families.

Besides the States and the District of Columbia, Puerto Rico, and the Virgin Islands received surplus commodities from the Corporation.

Distribution varied widely from month to month, depending again on supplies available and caseloads. In July 1938, 115 million pounds of foodstuffs were distributed, while in October 1938, 209 million pounds were distributed. The average distribution each month was 164.2 million pounds.

Surpluses and the school lunch program.

The school lunch distribution program was a relatively new activity during the past year. Under this program, each month more than half a million undernourished school children in 8,632 schools were served free lunches partly or wholly made up of surplus foods donated

by the Corporation. The program expanded rapidly during the school year, and at the peak served nearly 900,000 children in 14,000 schools.

About 29,000,000 pounds of surplus foods were used in preparing school lunches for undernourished children. Oranges and grapefruit were the most plentiful of the fresh fruits available for this purpose. Raisins and dried peaches added to the fruit supply. Butter and dry skim milk were important among the dairy products, while the list of staples included potatoes, rice, dried beans, wheat cereal, corn meal, and white and whole wheat flour. These supplies of surplus commodities formed the nucleus of the school lunches. Local contributions furnished the food needed to prepare well-rounded lunches.

While the Corporation established regulations governing the eligibility of schools and setting limits on quantities of surplus commodities which might be used in these programs, the school lunch programs were sponsored, operated and administered by local educational, civic and welfare agencies in cooperation with the State welfare agencies. In many instances the local sponsoring agencies received aid from the Works Projects Administration in the form of labor and in some cases, materials. Full recognition is given to the invaluable assistance and cooperation shown by the various interested agencies and individuals. Without this team-work there could not have been a school-lunch program.

School officials and health and nutrition authorities enthusiastically endorsed the school lunch program. They reported that children receiving the lunches showed gains in weight and had fewer illnesses and absences from school than before the program began.

At the close of the fiscal year, plans had been made for a definite expansion of this program during the 1939–40 school year. It was hoped that by the end of that year 5,000,000 undernourished children would be receiving these lunches daily. Such expansion would not only assure that many more children would receive at least one nourishing and well balanced meal every day, but it would also furnish additional outlets for farm surpluses.

THE WHEAT EXPORT PROGRAM

In August 1938, a program was instituted to encourage exports of United States wheat and flour. This was to be accomplished through the purchase of wheat in the domestic market and sale of this wheat to exporters at prices which would enable them to meet world competition. Payments were made, under the direction of the Division of Marketing and Marketing Agreements of the Department of Agriculture, for flour exports on the basis of the difference between domestic and export flour prices. The Corporation handled the operations of the wheat-export program. At the same time, it purchased wheat products for distribution to people receiving public assistance in the United States.

The export program was developed to maintain the United States' fair share of world trade and, along with other programs, to improve wheat prices. With record world supplies of wheat, including the third largest crop in the United States since 1915, increasing barriers to world trade, and numerous devices in effect to support or subsidize export trade in competing countries, it was certain that United States

export trade would be very limited and domestic prices greatly depressed, without Government support.

The Corporation set up regional offices for the purchase and sale of wheat for export, and received daily offers from the trade to buy and sell. On the basis of the current market, domestic and world, daily offers could be accepted or rejected. By June 30, 1939, the Corporation had sold nearly 70 million bushels of wheat. The average cost per bushel sold for export was about 30 cents, so that the total cost of the wheat export sales program was about $21,000,000.

The principal effects of the export program appear to have been to maintain for the United States a fair share of world wheat market, to reduce the potential carryover of United States wheat, and to increase the prices received by United States wheat producers.

THE FOOD STAMP PLAN FOR DISTRIBUTING FARM SURPLUSES

Consumer income studies made a few years ago showed that 40,000,000 of our people are living in families whose average cash income is only $9 a week. About one-half of these people have been getting some form of public assistance, and it has been estimated that many millions of families in this group are spending an average of only $1 a week per person for food. That means 15 cents a day, or 5 cents a meal for food purchases. This is an important reason why farmers have had trouble marketing part of their production, and why malnutrition has been a vital problem for our low-income people.

The food order stamp plan developed out of the search for an approach to this problem, out of the need for an expanded home market for the producer and a more nearly adequate food supply for millions of low-income families.

Under the stamp plan, which is entirely voluntary, relief families may purchase orange colored stamps at the rate of $1 a week for each member of the family as a minimum, or at the rate of $1.50 a week for each member of the family as a maximum. For each dollar's worth of orange colored stamps purchased, 50 cents worth of blue surplus stamps are given free to the family. Both types of stamps can be used for food in any grocery store in the area in which the plan is in operation. The orange colored stamps can be used for any food usually purchased in grocery stores and also for such items as soap and starch, but cannot be used for tobacco or alcoholic beverages. The blue surplus stamps can be used only for those food products declared by the Secretary of Agriculture to be surplus and which are listed on the surplus-commodity bulletin in force currently. The blue surplus stamps represent a 50 percent increase in food purchases by relief families. They mean that each member of the family can spend at least $1.50 for food, instead of the $1 which was being spent in most instances before food stamps were available.

In addition to providing a wider market for the farmer and supplementing the food diet of relief families, the operations of the stamp plan program help business by bringing about an increased flow of foodstuffs through the normal channels of trade.

Following the inauguration of the stamp plan in Rochester, N. Y., plans were made to put the program in operation on an experimental basis in five other cities during the summer of 1939. Operations

began in Dayton, Ohio, early in June, and Seattle, Wash., was selected before the end of the month. Birmingham, Ala.; Des Moines, Iowa; and Pottawatomie County, Okla., were to follow as soon as possible. Preliminary studies showed that the mechanical operation of the plan was satisfactory and that the results accomplished were encouraging enough to warrant gradual expansion to other cities throughout the country. It was evident that a much longer period would be necessary to determine definitely the complete economic effect of the program upon farm prices. Continued close study and observation, therefore, will accompany the gradual expansion.

However, it was evident early in the program that the stamp plan promises significant new markets for various agricultural commodities. Actual purchases made with the blue surplus stamps indicate that low-income consumers, given increased buying power, will purchase materially increased quantities of dairy and poultry products, and fruits and vegatables, as well as other agricultural commodities. The potential new market for these elastic demand commodities, if the stamp plan were in operation on a national basis, is of vital interest to agricultural producers.

Present conditions seem to warrant the expansion of the food stamp plan to include upwards of 100 cities or areas by the end of the 1940 fiscal year. Prices of many surplus agricultural products are still so low that the returns to farmers do not provide a fair exchange value for the manufactured goods which farmers must buy, and there are millions of our citizens who are existing on inadequate diets.

Within each city, however, there is a possibility that the number of families eligible to participate will decline if the current trend toward fuller employment continues. A man with a job at good wages provides the farmer with an even broader market than can be made possible through food stamps, and he provides the grocer with a greater volume of business than he is now getting even in cities where the stamp plan is in operation.

From the very beginning, an effort has been made to build the administrative machinery of the food stamp plan upon an "accordion basis." In times of great agriculural surpluses, which usually are accompanied by great unemployment, it will be there to do a minimum job in terms of minimum diets below which the public health would be endangered. The broader market thus made possible for farmers in times of stress would help to stabilize our whole economy. In times of fuller employment, however, it can and should be restricted to the fewer families who would still be elibigle for such assistance.

The stamp plan program is flexible enough to meet changing conditions, and future decisions as to its expansion or contraction will be based upon these conditions. All of the increased distribution and surplus-removal programs are subject to this same adjustment. They are designed primarily to assist farmers in moving price-depressing surpluses and widening their markets, and the extent of operations under them will be governed by current conditions.

TABLE I.—*Purchases and expenditures by the Federal Surplus Commodities Corporation by commodities, for the fiscal year ended June 30, 1939* [1]

COMMODITY	Unit	Quantity purchased	Total cost
	1	2	3
Apples, fresh	Bushels	555,584	$596,604
Beans:			
Dry	Pounds	76,409,500	2,090,313
Green	Bushels	33,620	17,854
Beets	Bushels	322,339	135,467
Blackberries, canned	Cases	76,960	134,600
Butter	Pounds	122,286,750	34,704,169
Cabbage	Pounds	118,962,085	1,102,370
Carrots	Bushels	152,102	72,269
Cauliflower	Crates	21,448	17,968
Celery	Crates	30,837	44,242
Corn, fresh	Bushels	17,730	4,606
Corn meal	Barrels	859,918	2,809,601
Cotton, raw baled	Bales	29,190	1,024,418
Cotton containers	Number	197,095	17,650
Cotton ticking	Yards	3,798,441	328,409
Eggs, shell	Cases	107,697	532,134
Grapefruit	Boxes	1,954,533	2,100,333
Mesh Bags	Number	649,870	62,625
Grapefruit juice	Cases	2,419,029	2,966,999
Milk:			
Dry skim	Pounds	13,997,211	706,931
Paper bags	Number	13,156,975	92,964
Evaporated	Cases	73,600	172,147
Fluid	Quarts	61,265,821	3,349,251
Onions	Bushels	232,785	168,176
Oranges	Boxes	1,834,279	2,937,792
Mesh bags	Number	460,000	41,958
Peaches:			
Dried	Pounds	10,480,954	772,500
Fresh	Bushels	5,959	6,924
Pears, fresh	Boxes	295,299	400,552
Peas, fresh	Bushels	2,598	2,808
Plums, fresh	Boxes	32,355	25,269
Potatoes:			
Sweet	Bushels	378,088	193,073
White	Bushels	2,264,499	1,417,929
Prunes, fresh	Bushels	13,743	21,927
Raisins	Pounds	20,199,000	946,814
Rice	Pounds	12,758,000	383,049
Syrup, cane	Cases	36,784	88,182
Tomatoes:			
Canned	Cases	66,701	88,949
Fresh	Bushels	109,237	73,327
Wheat cereal	Barrels	340,015	1,200,573
Graham flour	Barrels	314,996	1,110,585
White flour	Barrels	908,299	3,603,552
Total			66,567,863

[1] Includes transportation, processing and other handling costs which are subject to some revision. A portion of these costs represent encumbrances for transportation and processing of commodities purchased in the current fiscal year that will be paid in the 1940 fiscal year.

TABLE II.—*Distribution of foodstuffs donated by the Federal Surplus Commodities Corporation, by States, July 1, 1938, through June 30, 1939*

States:	Number pounds distributed	States—Continued.	Number pounds distributed
Alabama	29, 718, 859	New Jersey	52, 580, 384
Arizona	7, 622, 915	New Mexico	8, 852, 661
Arkansas	33, 046, 361	New York	125, 907, 238
California	68, 520, 842	North Carolina	31, 102, 910
Colorado	16, 449, 925	North Dakota	39, 462, 897
Connecticut	15, 029, 193	Ohio	96, 345, 463
Delaware	1, 530, 037	Oklahoma	54, 728, 765
Florida	25, 232, 182	Oregon	10, 298, 613
Georgia	55, 016, 675	Pennsylvania	90, 104, 918
Idaho	11, 362, 201	Rhode Island	6, 912, 951
Illinois	166, 699, 791	South Carolina	24, 665, 591
Indiana	38, 134, 749	South Dakota	39, 462, 897
Iowa	23, 735, 121	Tennessee	27, 723, 449
Kansas	32, 390, 409	Texas	49, 730, 333
Kentucky	42, 498, 757	Utah	9, 793, 308
Louisiana	53, 830, 665	Vermont	5, 575, 171
Maine	22, 586, 123	Virginia	15, 570, 254
Maryland	12, 383, 060	Washington	26, 942, 224
Massachusetts	191, 289, 895	West Virginia	29, 102, 792
Michigan	95, 725, 519	Wisconsin	39, 967, 853
Minnesota	57, 333, 539	Wyoming	4, 400, 646
Mississippi	56, 189, 297	District of Columbia	10, 962, 666
Missouri	44, 942, 795	Puerto Rico	14, 552, 584
Montana	16, 074, 344	Virgin Islands	27, 681
Nebraska	24, 968, 475		
Nevada	1, 774, 829		
New Hampshire	12, 740, 107	Total	1, 970, 079, 155

TABLE III.—*Federal Surplus Commodities Corporation foodstuffs distributed and number of families and persons served, July 1, 1938–June 30, 1939*

Item	Pounds of food issued during year	Number families served during year	Number persons served during year
	1	2	3
Total actual distribution	1, 970, 079, 155	2, 858, 750	10, 524, 489
Issues to—			
(*a*) General cases	1, 917, 922, 183	2, 852, 521	10, 499, 183
(*b*) Indian cases	4, 509, 355	6, 229	25, 306
(*c*) School lunch program and nursery schools	28, 734, 901	[1] 8, 632	[2] 528, 386
(*d*) Institutions and organizations	16, 861, 874	[3] 1, 081	[2] 303, 454
(*e*) Others	2, 050, 842		[2] 29, 500

[1] Number of schools.
[2] Not included in total persons.
[3] Number of institutions.

TABLE IV.—*Federal Surplus Commodities Corporation Combined Balance Sheet as of June 30, 1939*

[All classes of funds]

ASSETS

Cash		$23,136,199.09
Imprest Fund: For procurement of supplies		1,276.72
Trust fund: From sale of hides and skins for U. S. Treasury		453,929.19
Accounts receivable		323,056.07
Indemnities receivable		16,701,235.65
Inventories:		
Canned grapefruit juice	$130,952.77	
Cotton	15,507.63	
Butter	6,225,947.69	
Hides and skins	71,663.70	
Timber products	7,574,292.97	
Wheat	3,977,473.27	
		17,995,838.03
Operating supplies and equipment		96,487.99
Office supplies and equipment		4,441.60
Total assets		58,712,464.34

LIABILITIES

Accounts payable:		
Trade creditors	$11,766,609.99	
Contractors for cash guarantees	544,272.60	
		12,310,882.59
Trust obligation to the U. S. Treasury: For proceeds sales of hides and skins		454,298.48
Interest payable		378,941.21
Notes payable		30,197,105.92
Reserve for redemption of food order stamps		136,784.25
Surplus		15,234,451.89
Total liabilities		58,712,464.34

REPORT OF THE DIRECTOR OF FINANCE, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF BUDGET AND FINANCE,
Washington, D. C., October 12, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the Office of Budget and Finance for the fiscal year ended June 30, 1939.

Sincerely,

W. A. JUMP, *Director.*

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THE DEPARTMENT BUDGET

This report shows for the regular funds of the Department of Agriculture the appropriations and obligations for the fiscal year 1939 and the 1940 appropriations, and for emergency funds the amounts allocated to and obligated by the Department during 1939.

The term "regular funds" refers to all appropriations or reappropriations provided by the annual appropriation acts and acts supplementary thereto such as deficiency appropriation acts, laws relating to receipts and contributed funds made annually available for administration by the Department, agricultural adjustment and related activities, the programs authorized under the Bankhead-Jones Farm Tenant Act, and other special laws appropriating funds which augment or extend the Department's regular or normal activities.

The term "emergency funds" relates to the allocations which the Department of Agriculture has received under acts passed by Congress primarily to meet unemployment or other relief situations.

REGULAR FUNDS

During the fiscal year 1939 direct appropriations for the regular activities of the Department aggregated $1,311,001,623, to which was added reappropriations of $221,755,000 from balances of prior-year appropriations, making a total of $1,532,756,623 available. Against this sum, obligations totaling $1,310,359,389 were incurred, as shown in table 1.

188588—39——1

TABLE 1.—*Regular appropriations and obligations of the Department of Agriculture, fiscal year 1939*

[For details, see tables 4 and 5]

Item	Appropriations, 1939	Obligations, 1939
Agricultural adjustment and related funds	$937,824,893	$802,990,261
Farm tenancy, rehabilitation, and related work	238,923,000	217,866,805
Road funds	201,500,000	150,316,451
Payments to States for experiment stations, extension work, and cooperative forestry activities, including fire prevention	27,558,833	26,982,663
All other purposes	126,949,897	112,203,209
Gross total (all regular funds)	1,532,756,623	1,310,359,389
Deduct reappropriations included in foregoing	221,755,000	
Net total, regular funds (direct appropriations)	1,311,001,623	1,310,359,389

EMERGENCY FUNDS

For 1939, emergency funds amounting to $38,393,159 were allocated to the Department. Obligations totaling $34,502,010 were incurred against these allocations and balances from allocations made in prior years, as shown in table 2.

TABLE 2.—*Emergency funds allocated to Department of Agriculture, fiscal year 1939*

[For details, see table 9]

Act	Allocations, 1939	Obligations, 1939
National Industrial Recovery Act		$701,152
Supplemental Appropriation Act, 1936 (substitution for Puerto Rico and Hawaii trust funds under appropriation Payments for agricultural adjustment)		10,885
Emergency Relief Appropriation Act of 1935		9,375
Emergency Relief Appropriation Act of 1938	$30,524,988	28,317,521
Public Works Administration Act of 1938	7,868,171	5,463,077
Total	38,393,159	34,502,010

STATISTICAL TABLES

Tables 3 to 9, inclusive, analyze the Department's regular budget for the fiscal years 1939 and 1940, and show in some detail the allocations and obligations under emergency funds for 1939. At the time this report was being prepared (October 1, 1939), it was of course impracticable to forecast allocations from emergency funds for the fiscal year 1940 as a whole; data for the complete fiscal year 1940 will be included in next year's report.

TABLE 3.—*Source of regular appropriations of Department of Agriculture, fiscal years 1939 and 1940*

Source	Appropriation, 1939 (revised)	Appropriation, 1940 [1]
Agricultural Appropriation Act:		
Department proper:		
Direct appropriation	[2] $347,865,279	[3] $175,721,215
Reappropriations from prior-year balances:		
Eradicating tuberculosis and Bang's disease	7,827,000	4,000,000
Eradication of European fowl pest	5,000	5,000
Farm Tenant Act:		
Title I (tenancy loans)	710,000	575,000
Title III (submarginal land program)	8,213,000	2,445,000
Agricultural Adjustment and related funds:		
Conservation and use of agricultural land resources, Department of Agriculture:		
Direct appropriation	345,000,000	429,560,000
Reappropriation	155,000,000	70,000,000

[1] As of Oct. 1, 1939.

[2] Includes appropriations for Bureau of Biological Survey and Bureau of Public Roads.

[3] Excludes Bureau of Biological Survey and Bureau of Public Roads, transferred to other agencies pursuant to the Reorganization Act of 1939 and Reorganization Plans Nos. I and II (H. Docs. 262 and 288, 76th Cong.); also excludes transfers (aggregating $137,127) from various Department of Agriculture bureaus to other Federal agencies incident to reorganization.

TABLE 3.—*Source of regular appropriations of Department of Agriculture, fiscal years 1939 and 1940*—Continued

Source	Appropriation, 1939 (revised)	Appropriation, 1940
Agricultural Appropriation Act—Continued.		
Agricultural Adjustment and related funds—Continued.		
Price Adjustment Act of 1938 (parity payments)		$225,000,000
Sugar Act of 1937:		
Direct appropriation	$48,000,000	31,975,000
Reappropriation		16,000,000
Disposal of surplus commodities		113,000,000
Retirement of cotton pool participation trust certificates	1,800,000	
Federal Crop Insurance Act:		
Direct appropriation		5,423,200
Reappropriation	25,500,000	500,000
Section 32, act of Aug. 24, 1935 (exportation and domestic consumption of agricultural commodities, Department of Agriculture)	144,024,893	92,678,812
Second Deficiency Appropriation Act, 1938:		
Incipient and emergency outbreaks of plant pests	700,000	
Maintenance of mammal and bird reservations	60,000	
Administration of United States Warehouse Act	55,000	
Mediterranean Fruit Fly Board, expenses	10,000	
First Deficiency Appropriation Act, 1939:		
National forest protection and management (White Mountain National Forest hurricane damage)	500,000	
New England hurricane damage	5,000,000	
Incipient and emergency outbreaks of plant pests	3,000,000	
Second Deficiency Appropriation Act, 1939:		
Fighting forest fires	2,480,000	
Dutch elm disease eradication	100,000	
Enforcement of Federal Food, Drug, and Cosmetic Act	15,000	
Sugar Act of 1937:		
Direct appropriation	5,000,000	
Reappropriation	1,500,000	
Act of June 13, 1939 (Public Res. No. 22, 76th Cong.): Incipient and emergency outbreaks of plant pests	1,750,000	
Third Deficiency Appropriation Act, 1939:		
Administration of United States Warehouse Act		17,500
Restoration, capital impairment, Commodity Credit Corporation (Treasury Department)	[4]	[5]
Work Relief and Public Works Appropriation Act of 1938:		
Loans, relief, and rural rehabilitation—section 1 (3) of title I (Emergency Relief Appropriation Act of 1938):		
Direct appropriation	175,000,000	
Reappropriation	23,000,000	
Price Adjustment Act of 1938 (parity payments)—title V	212,000,000	
Emergency Relief Appropriation Act of 1939: Loans, relief, and rural rehabilitation—section 3:		
Direct appropriation		143,000,000
Reappropriation		17,700,000
Independent Offices Appropriation Act: Rural Electrification Administration	[4]	42,790,000
War Department Civil Appropriation Act (transferred to Department of Agriculture): Flood control work	7,000,000	3,000,000
Permanent annual, indefinite, and special appropriations:		
Cooperative agricultural extension work (Smith-Lever Act)	4,701,165	4,701,165
Payments to States and Territories (national-forest fund)	1,114,700	1,275,000
Payments to school funds, Arizona and New Mexico (national-forest fund)	30,000	30,000
Roads and trails for States (national-forest fund)	510,000	510,000
Cooperative work, Forest Service (contributed funds)	1,000,000	1,000,000
Payments to counties under Migratory Bird Conservation Act	15,000	
Farm-products inspections (fees)—Agricultural Marketing Service	75,588	103,228
Sea-food inspections, refunds to depositors (Food and Drug Administration)	29,698	29,000
Payments in lieu of taxes and for operation and maintenance of resettlement projects (trust account)—Farm Security Administration	1,200,000	1,800,000
State Rural Rehabilitation Corporation funds (trust account)—Farm Security Administration	2,840,000	2,875,000
Miscellaneous contributed funds (trust account)	[6] 125,300	44,500
Grand total available, regular funds (including reappropriations)	1,532,756,623	1,385,758,620
Deduct reappropriations, as listed above	221,755,000	111,225,000
Total, direct appropriations	1,311,001,623	1,274,533,620

[4] The Commodity Credit Corporation and the Rural Electrification Administration, which were independent agencies during the fiscal year 1939, were transferred to the Department of Agriculture on July 1, 1939, pursuant to the Reorganization Act of 1939 and Reorganization Plans Nos. I and II.

[5] The Third Deficiency Appropriation Act, 1939, provides to the Treasury Department $119,599,918 for restoration of the capital impairment of the Commodity Credit Corporation as of Mar. 31, 1939 (listed as a 1940 appropriation); an appropriation of $94,285,405 was made for this purpose, fiscal year 1938.

[6] Includes $3,620 under Bureau of Biological Survey.

TABLE 4.—*Summary of regular Department of Agriculture funds, classified by groups and bureau units, fiscal years 1939 and 1940*

[For details see tables 5 and 6]

Activity	Appropriation, 1939 (revised)	Obligations, 1939	Appropriation, 1940 [1]
Ordinary activities:			
Office of the Secretary	$870,825	$844,719	$896,447
Office of the Solicitor	232,480	231,686	231,280
Office of Information	1,474,770	1,474,270	1,965,910
Library	105,420	104,920	107,970
Office of Experiment Stations	228,980	228,241	244,735
Special Research Fund, Department of Agriculture	1,400,000	1,365,935	1,400,000
Extension Service	892,254	872,297	927,864
Office of Foreign Agricultural Relations	295,000	294,250	196,396
Weather Bureau	4,987,870	4,944,263	6,172,870
Bureau of Animal Industry	21,578,752	17,439,707	20,668,712
Bureau of Dairy Industry	717,405	709,047	721,405
Bureau of Plant Industry	5,110,337	5,052,317	5,183,009
Forest Service	14,410,400	[2] 15,384,531	14,923,466
Bureau of Agricultural Chemistry and Engineering	1,424,169	1,407,548	1,379,369
Bureau of Entomology and Plant Quarantine	5,721,867	5,658,603	6,199,809
Bureau of Biological Survey	2,123,340	2,123,081	[3]
Bureau of Agricultural Economics	891,000	871,650	928,000
Agricultural Marketing Service	5,824,555	5,720,173	6,096,388
Bureau of Home Economics	305,085	303,000	325,085
Commodity Exchange Administration	623,380	619,545	623,380
Food and Drug Administration	2,241,138	2,228,506	2,741,138
Soil Conservation Service	23,645,584	23,060,590	23,720,584
Beltsville Agricultural Research Center	85,000	84,500	85,000
Total	95,189,611	91,023,379	95,738,817
Special items (including forest roads and trails)	31,020,000	24,487,233	14,050,000
Receipts and contributed funds	7,740,286	9,035,414	7,737,728
Payments to States (exclusive of road and receipt funds)	27,558,833	26,982,663	27,619,333
Farm Tenant Act	40,923,000	37,583,812	49,985,730
Loans, relief, and rural rehabilitation	198,000,000	180,282,993	160,700,000
Agricultural adjustment and related funds	937,824,893	802,990,261	984,137,012
Rural electrification	[4]		42,790,000
Federal highways (exclusive of forest roads and trails)	187,500,000	136,316,451	[5]
Flood control (transfer from War Department)	7,000,000	1,657,183	3,000,000
Grand total, regular funds, Department of Agriculture (including reappropriations)	1,532,756,623	1,310,359,389	1,385,758,620
Deduct reappropriations included in foregoing	−221,755,000		−111,225,000
Total, direct appropriations, regular funds, Department of Agriculture	1,311,001,623	1,310,359,389	1,274,533,620

[1] As of Oct. 1, 1939.

[2] Includes $1,000,000 provided by Second Deficiency Appropriation Act, fiscal year 1938, for repair of flood damages to California national forests, and continued available until Sept. 30, 1938; all obligated in 1939.

[3] The Bureau of Biological Survey was transferred to Department of the Interior on July 1, 1939, pursuant to the Reorganization Act of 1939 and Reorganization Plan No. II.

[4] The Rural Electrification Administration was an independent Federal agency prior to July 1, 1939; on which date, pursuant to the Reorganization Act of 1939 and Reorganization Plan No. II, it was transferred to the Department of Agriculture.

[5] The Bureau of Public Roads was transferred to the Federal Works Agency on July 1, 1939, pursuant to the Reorganization Act of 1939 and Reorganization Plan No. I.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1939 and 1940*

Bureau and item	Appropriation, 1939 (revised)	Obligations, 1939	Appropriation, 1940 [1]
Ordinary activities:			
Office of the Secretary:			
Salaries	$581,920	$573,112	[2] $597,620
Miscellaneous expenses	108,250	99,692	[3] 107,750
Rent of buildings in District of Columbia	180,655	171,915	[4] 191,077
Total	870,825	844,719	896,447
Office of the Solicitor: Salaries and expenses	232,480	231,686	[5] 231,280
Office of Information:			
Salaries and expenses	379,800	379,300	[6] 379,040
Printing and binding	1,094,970	1,094,970	[7] 1,586,870
Total	1,474,770	1,474,270	1,965,910
Library, Department of Agriculture: Salaries and expenses	105,420	104,920	[8] 107,970
Office of Experiment Stations:			
Administration of grants to States and coordination of research	161,735	161,001	161,735
Insular experiment stations (Puerto Rico)	67,245	67,240	83,000
Total	228,980	228,241	244,735
Special Research Fund	1,400,000	1,365,935	1,400,000
Extension Service:			
General administrative expenses	126,246	122,959	126,246
Farmers' cooperative demonstration work	545,170	531,653	560,170
Motion pictures	79,000	76,327	[9] 78,550
Agricultural exhibits at fairs	85,000	84,965	85,000
Cooperative farm forestry extension work	56,838	56,393	77,898
Total	892,254	872,297	927,864
Office of Foreign Agricultural Relations: Salaries and expenses	[10] 295,000	294,250	[11] 196,396
Weather Bureau:			
General administrative expenses	145,000	144,254	145,000
General weather service and research	2,342,870	2,329,864	2,527,870
Airways weather service and research	2,500,000	2,470,145	3,500,000
Total	4,987,870	4,944,263	6,172,870
Bureau of Animal Industry:			
General administrative expenses	170,120	168,532	170,120
Animal husbandry	789,380	783,829	802,880
Diseases of animals	447,000	445,351	462,000
Eradicating tuberculosis and Bang's disease:			
Direct appropriation	5,403,000	9,178,069	8,300,000
Reappropriations from prior-year balances	7,827,000		4,000,000
Eradicating cattle ticks	503,940	471,615	475,000
Hog-cholera control	122,000	116,558	122,000
Inspection and quarantine	680,000	661,013	680,000
Meat inspection	5,412,600	5,401,736	5,433,000
Virus-Serum-Toxin Act	218,712	213,004	218,712

[1] As of Oct. 1, 1939.
[2] Includes $21,600 transferred from Farm Credit Administration and excludes $5,900 transferred to Department of the Interior incident to reorganization.
[3] Excludes $500 transferred to Department of the Interior incident to reorganization.
[4] Excludes $2,523 transferred to Department of the Interior incident to reorganization.
[5] Excludes $1,200 transferred to Department of the Interior incident to reorganization.
[6] Excludes $4,000 transferred to Department of the Interior incident to reorganization.
[7] Excludes $18,000 transferred to Department of the Interior and $4,700 to Public Roads Administration incident to reorganization. The amount for 1940 includes $591,570 transferred from other Department appropriations used for printing and binding in prior years.
[8] Excludes $500 transferred to Public Roads Administration and $750 transferred to Department of the Interior incident to reorganization.
[9] Excludes $450 transferred to Department of the Interior incident to reorganization.
[10] Carried in 1939 Agricultural Appropriation Act under title "Foreign competition and demand," Bureau of Agricultural Economics.
[11] Carried in 1940 Agricultural Appropriation Act under title "Foreign Agricultural Service;" excludes $98,604 transferred with functions of the Foreign Agricultural Service to Department of State, pursuant to provisions of the Reorganization Act of 1939 and Reorganization Plan No. II.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1939 and 1940*—Continued

Bureau and item	Appropriation, 1939 (revised)	Obligations, 1939	Appropriation, 1940
Ordinary activities—Continued.			
Bureau of Animal Industry—Continued.			
Marketing agreements with respect to hog cholera virus and serum	[12]	[13]	[12]
Eradication of European fowl pest (reappropriation)	$5,000		$5,000
Total	21,578,752	$17,439,707	20,668,712
Bureau of Dairy Industry:			
General administrative expenses	70,495	70,461	75,500
Dairy investigations	646,910	638,586	645,905
Total	717,405	709,047	721,405
Bureau of Plant Industry:			
General administrative expenses	202,442	202,049	202,442
Arlington farm	49,414	48,531	49,414
Botany	76,635	75,662	76,635
Cereal crops and diseases	541,121	535,427	551,121
Cotton and other fiber crops and diseases	399,385	395,020	424,385
Drug and related plants	47,139	42,115	47,139
Dry-land agriculture	226,828	224,188	226,828
Experimental greenhouse maintenance	77,372	76,608	77,372
Forage crops and diseases	298,443	295,152	313,450
Forest pathology	255,392	252,194	265,392
Fruit and vegetable crops and diseases	1,296,982	1,287,018	1,348,982
Genetics and biophysics	31,675	31,419	31,675
Irrigation agriculture	152,674	151,353	152,674
Mycology and disease survey	45,818	45,358	45,818
National Arboretum	54,587	53,733	54,587
Nematology	48,961	48,231	48,961
Plant exploration and introduction	200,933	198,630	200,933
Plant nutrition	16,024	15,871	16,024
Rubber and other tropical plants	46,749	46,409	46,749
Soil chemical and physical investigations	76,700	76,264	76,700
Soil-fertility investigations	168,457	167,313	121,622
Soil-microbiology investigations	39,854	39,525	39,854
Soil survey	298,708	292,077	298,708
Sugar-plant investigations	322,500	320,247	330,000
Tobacco investigations	135,544	131,923	135,544
Total	5,110,337	5,052,317	5,183,009
Forest Service:			
General administrative expenses	607,500	607,500	607,500
National-forest protection and management	11,569,754	11,548,000	12,004,000
Reconstruction and repair of roads and other improvements, national forests in California	[14]	1,000,000	
Water rights	20,000	19,371	20,000
Fighting forest fires	100,000	100,000	100,000
Private forestry cooperation	100,000	97,453	100,000
Forest management	648,403	648,267	613,403
Range investigations	225,935	225,754	245,935
Forest products	628,361	628,311	664,181
Forest survey	250,000	249,806	250,000
Forest economics	121,295	121,163	149,295
Forest influences	139,152	138,906	139,152
Tropical forest experiment station			30,000
Total	14,410,400	15,384,531	14,923,466
Bureau of Agricultural Chemistry and Engineering:			
General administrative expenses	112,800	112,196	112,800
Agricultural-chemical investigations	372,500	368,526	411,500
Industrial utilization of farm products and byproducts	236,200	232,957	191,200
Agricultural-engineering investigations	359,469	352,995	349,469
Naval-stores investigations	79,400	78,416	89,400
Fertilizer investigations	263,800	262,458	225,000
Total	1,424,169	1,407,548	1,379,369

[12] $30,000 allotment from continuing appropriation made by sec. 12 (a) of Agricultural Adjustment Act of 1938.

[13] For obligations hereunder, see table 6, under Salaries and Expenses, Agricultural Adjustment Administration.

[14] A $1,000,000 appropriation was provided for 1938 by the Second Deficiency Appropriation Act, fiscal year 1938, to continue available until Sept. 30, 1938; none obligated in 1938.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1939 and 1940*—Continued

Bureau and item	Appropriation, 1939 (revised)	Obligations, 1939	Appropriation, 1940
Ordinary activities—Continued.			
Bureau of Entomology and Plant Quarantine:			
General administrative expenses	$166,280	$165,281	$166,280
Fruit insects	428,600	421,049	428,600
Japanese beetle control	395,000	393,894	395,000
Mexican fruitfly control	160,460	158,399	160,460
Citrus canker eradication	13,485	13,437	13,485
Sweetpotato weevil control	75,000	67,579	75,000
Phony peach and peach mosaic eradication	89,800	89,387	89,800
Forest insects	253,100	251,291	253,100
Gypsy and brown-tail moth control	375,000	372,924	375,000
Blister rust control	300,000	297,235	300,000
Dutch elm disease eradication	[15] 478,489	476,229	500,000
Truck crop and garden insects	381,580	380,589	381,580
Cereal and forage insects	363,669	362,169	383,700
European corn borer control	32,939	26,739	32,939
Barberry eradication	200,000	198,851	175,000
Cotton insects	144,544	143,834	144,544
Pink bollworm control	446,800	445,442	906,800
Thurberia weevil control	2,808	2,784	2,808
Bee culture	83,000	82,500	83,000
Insects affecting man and animals	191,100	189,491	181,500
Insect pest survey and identification	149,790	149,746	154,790
Foreign parasites	38,000	37,794	38,000
Control investigations	72,518	72,243	67,518
Insecticide and fungicide investigations	123,984	122,990	134,984
Transit inspection	44,059	43,290	44,059
Foreign plant quarantines	680,000	662,770	680,000
Certification of exports	31,862	30,666	31,862
Total	5,721,867	5,658,603	6,199,809
Bureau of Biological Survey:			
General administrative expenses	110,000	109,700	
Food habits of birds and animals	68,140	67,432	
Fur resources investigations	91,000	88,789	
Biological investigations	171,149	169,482	
Control of predatory animals and injurious rodents	650,000	644,774	
Protection of migratory birds	315,000	308,639	
Enforcement of Alaska game law	130,798	130,100	
Maintenance of mammal and bird reservations	[16] 507,500	504,257	
Migratory bird conservation refuges	79,753	78,874	
Upper Mississippi River Wildlife Refuge		21,034	
Total	2,123,340	2,123,081	[17]
Bureau of Agricultural Economics:			
General administrative expenses	88,900	88,861	88,900
Economic investigations	802,100	782,789	839,100
Total	891,000	871,650	928,000
Agricultural Marketing Service:			
General administrative expenses	157,306	157,306	157,306
Marketing farm products	426,620	415,351	431,470
Crop and livestock estimates	642,799	640,118	747,510
Market inspection of farm products	450,000	449,595	459,000
Tobacco Inspection Act	375,000	364,996	425,000
Tobacco stocks and standards	17,187	17,186	17,187
Market news service	1,112,302	1,108,263	1,138,302
Perishable Agricultural Commodities and Produce Agency Acts	149,628	149,491	155,000
Standard Container Acts	22,000	20,237	20,000
Cotton Quality Statistics and Classing Acts	430,000	407,999	475,000
United States Cotton Futures and United States Cotton Standards Acts	491,900	463,991	495,000
United States Grain Standards Act	723,941	716,239	723,941
United States Warehouse Act	[18] 391,700	384,594	[19] 417,500
Federal Seed Act	52,293	52,071	52,293
Packers and Stockyards Act	381,879	372,736	381,879
Total	5,824,555	5,720,173	6,096,388

[15] Includes $100,000 provided by Second Deficiency Appropriation Act, 1939.
[16] Includes $60,000 provided by Second Deficiency Appropriation Act, 1938.
[17] The Bureau of Biological Survey was transferred to Department of the Interior on July 1, 1939, pursuant to the Reorganization Act of 1939 and Reorganization Plan No. II.
[18] Includes $55,000 provided by Second Deficiency Appropriation Act, 1938.
[19] Includes $17,500 provided by Third Deficiency Appropriation Act, 1939.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1939 and 1940*—Continued

Bureau and item	Appropriation, 1939 (revised)	Obligations, 1939	Appropriation, 1940
Ordinary activities—Continued.			
Bureau of Home Economics:			
General administrative expenses	$31,735	$31,585	$31,735
Home economics investigations	273,350	271,415	293,350
Total	305,085	303,000	325,085
Commodity Exchange Administration: Enforcement of Commodity Exchange Act	623,380	619,545	623,380
Food and Drug Administration:			
General administrative expenses	100,802	100,754	100,802
Enforcement of Federal Food, Drug, and Cosmetic Act	[20] 1,763,380	1,761,093	2,288,380
Enforcement of Tea Importation Act	40,094	39,129	30,094
Naval Stores Act	34,700	32,379	34,700
Enforcement of Insecticide Act	208,180	205,284	193,180
Enforcement of Milk Importation Act	19,241	18,087	19,241
Enforcement of Caustic Poison Act	24,741	23,238	24,741
Enforcement of Filled Milk Act	10,000	8,542	10,000
Enforcement of Sea Food Inspectors Act	40,000	40,000	40,000
Total	2,241,138	2,228,506	2,741,138
Soil Conservation Service:			
General administrative expenses	552,050	549,045	552,050
Soil and moisture conservation and land-use investigations	1,631,185	1,612,877	1,631,185
Soil and moisture conservation and land-use operations, demonstrations, and information	21,462,349	20,898,668	21,462,349
Emergency erosion control, Everglades region, Florida			75,000
Total	23,645,584	23,060,590	23,720,584
Beltsville Agricultural Research Center	85,000	84,500	85,000
Total, ordinary activities	95,189,611	91,023,379	95,738,817
Special items:			
Fighting forest fires	[21] 2,480,000	2,472,468	
Acquisition of lands for national forests	3,000,000	2,895,218	3,000,000
Cooperative farm forestry (act of May 18, 1937)			300,000
Forest roads and trails	14,000,000	14,000,000	10,000,000
Tobacco laboratory, Oxford, N. C. (Bureau of Entomology and Plant Quarantine)	80,000	79,000	
Building, Weather Bureau, Washington, D. C.			250,000
Incipient and emergency outbreaks of plant pests (acts of Apr. 6, 1937, and May 9, 1938)	[22] 5,450,000	4,130,800	
Water Facilities Act, arid and semi-arid areas	500,000	368,193	500,000
Mediterranean Fruit Fly Board	[23] 10,000	8,125	
New England hurricane damage	[24] 5,000,000	471,198	
Hurricane damage repair, White Mountain National Forest	[24] 500,000	62,231	
Total, special items	31,020,000	24,487,233	14,050,000
Receipts and contributed funds:			
Forest Service:			
Acquisition of lands from national-forest receipts	50,000	49,624	71,000
Payments to States and Territories	1,114,700	1,135,749	1,275,000
Payments to school funds, Arizona and New Mexico	30,000	31,466	30,000
Roads and trails for States	510,000	450,225	510,000
Cooperative work (contributed funds)	1,000,000	963,353	1,000,000
Bureau of Biological Survey:			
Migratory bird conservation fund	[25] 750,000	634,103	([26])
Payments to counties under Migratory Bird Conservation Act	15,000	11,245	([26])
Agricultural Marketing Service: Farm products inspections	75,588	35,816	103,228
Food and Drug Administration: Sea-food inspections, refunds to depositors	29,698	29,698	29,000

[20] Includes $15,000 provided by Second Deficiency Appropriation Act, 1939.
[21] Provided by Second Deficiency Appropriation Act, 1939.
[22] Consists of $700,000 provided by the Second Deficiency Appropriation Act, 1938, $3,000,000 by First Deficiency Appropriation Act, 1939, and $1,750,000 by the act of June 13, 1939 (Public Res. 22, 76th Cong.).
[23] Provided by Second Deficiency Appropriation Act, 1938.
[24] Provided by First Deficiency Appropriation Act, 1939.
[25] Estimated receipts from sale of hunting stamps; includes $125,000 advanced from Treasury by Agricultural Appropriation Act, to be reimbursed from hunting-stamp receipts.
[26] See footnote 17.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1939 and 1940*—Continued

Bureau and item	Appropriation, 1939 (revised)	Obligations, 1939	Appropriation, 1940
Receipts and contributed funds—Continued.			
Farm Security Administration:			
Payments in lieu of taxes and for operation and maintenance of resettlement projects	$1,200,000	$1,478,743	$1,800,000
State Rural Rehabilitation Corporation funds	2,840,000	4,090,092	2,875,000
Miscellaneous contributed funds	[27] 125,300	125,300	44.500
Total, receipts and contributed funds	7,740,286	9,035,414	7,737.728
Payments to States (exclusive of road and receipt funds):			
Office of Experiment Stations (for research work of State agricultural experiment stations):			
Hatch Act	720.000	720,000	720,000
Adams Act	720.000	720,000	720,000
Purnell Act	2,880,000	2,880,000	2,880,000
Hawaii	55,000	55,000	60,000
Alaska	23,750	23,750	23,750
Puerto Rico	42,500	42,500	45,000
Title I, Bankhead-Jones Act	2,100,000	2,100,000	2,400,000
Total	6,541,250	6,541,250	6,848.750
Extension Service (for extension work of State agricultural colleges):			
Smith-Lever Act (permanent annual)	4,701,165	4,701,165	4,701,165
Supplementary cooperative extension work (Smith-Lever Act)	395,000	395,000	
Capper-Ketcham extension work	1,480,000	1,480,000	1,480,000
Extension work, act of Apr. 24, 1939			203,000
Extension work, sec. 21, Bankhead-Jones Act	11,000,000	11,000,000	12,000,000
Alaska	21,418	21,418	21,418
Puerto Rico	45,000	45,000	65,000
Additional cooperative extension work	275,000	275,000	
Total	17,917,583	17,917,583	18,470,583
Forest Service:			
Forest-fire cooperation	2,000,000	1,997,393	2,200,000
Cooperative distribution of forest planting stock (Clark-McNary Act)	[28] 100,000	99,826	100,000
Total	2,100,000	2,097,219	2,300,000
Bureau of Biological Survey: Federal aid to States in wildlife restoration projects	1,000,000	426,611	[29]
Total, payments to States	27,558,833	26,982,663	27,619,333
Farm Tenant Act:			
Farm tenancy (loans, title I):			
Direct appropriation	25,000,000	24,998,353	40,000,000
Reappropriation from prior-year balance	710,000		575,000
Liquidation and management of resettlement projects (title IV)	2,000,000	1,880,208	1,987,400
Land utilization and retirement of submarginal land (title III):			
Direct appropriation	5,000,000	10,705,251	4,978,330
Reappropriation	8,213,000		2,445,000
Total, Farm Tenant Act	40,923,000	37,583,812	49,985,730
Loans, relief, and rural rehabilitation: [30]			
Direct appropriation	175,000,000	[31] 180,282,993	143,000,000
Reappropriation	23,000,000		17,700,000
Total, loans, relief, and rural rehabilitation	198,000,000	180,282,993	160,700,000
Agricultural adjustment and related funds:			
Salaries and expenses, Agricultural Adjustment Administration		1,603,644	
Payments for agricultural adjustment		263,956	
Conservation and use of agricultural land resources:			
Direct appropriation	345,000,000	499,941,630	429,560,000
Reappropriation	155,000,000		70,000,000

[27] Includes $3,620 under Bureau of Biological Survey.
[28] Carried in 1939 Agricultural Appropriation Act under title "Cooperative farm forestry."
[29] See footnote 17.
[30] This item carried in Emergency Relief appropriation acts.
[31] Obligated under the following projects: Direct relief (grants), $24,025,843; rehabilitation loans, $49,558,765; expenses incident to loans and relief, $17,441,624; rural rehabilitation projects, $5,584,371; expenses in connection with rehabilitation projects, $662,471; water facilities projects, $1,127,080; migratory labor camps, $4,988,250; and general administrative expenses, $6,894,589; total, $180,282,993.

TABLE 5.—*Detailed statement, by bureaus and appropriation items, of regular Department of Agriculture funds, fiscal years 1939 and 1940*—Continued

Bureau and item	Appropriation, 1939 (revised)	Obligations, 1939	Appropriation, 1940
Agricultural adjustment and related funds—Continued.			
Price Adjustment Act of 1938 (parity payments)	[32] $212,000,000	$29,000,000	[33] $225,000,000
Sugar Act of 1937:			
Direct appropriation	[34] 53,000,000	53,945,237	31,975,000
Reappropriation	[35] 1,500,000		16,000,000
Exportation and domestic consumption of agricultural commodities (sec. 32, act of Aug. 24, 1935)	144,024,893	[36] 207,236,081	92,678,812
Disposal of surplus commodities			113,000,000
Retirement of cotton pool participation trust certificates	1,800,000	1,207,615	
Federal Crop Insurance Act:			
Administrative and operating expenses:			
Direct appropriation		4,792,098	5,423,200
Reappropriation	5,500,000		500,000
Subscription to capital stock (Treasury Department):			
Reappropriation	20,000,000	5,000,000	
Commodity Credit Corporation: [37] Restoration of capital impairment (Treasury Department)			[38]
Total, agricultural adjustment and related funds	937,824,893	[39] 802,990,261	984,137,012
Rural electrification: [40]			
Salaries and expenses			2,700,000
Printing and binding			90,000
Rural electrification loans			40,000,000
Total, rural electrification			42,790,000
Federal highways (exclusive of forest roads and trails): [41]			
Federal aid (rural post roads)		[42] 316,451	
Federal-aid highway system	125,000,000	100,000,000	
Federal-aid secondary or feeder roads	20,000,000	15,000,000	
Elimination of grade crossings	40,000,000	20,000,000	
Public-lands highways	2,500,000	1,000,000	
Total, Federal highways (exclusive of forest roads and trails)	187,500,000	136,316,451	[43]
Flood control (transfer from War Department):			
Examinations and surveys for run-off and water-flow retardation and soil-erosion prevention on watersheds of flood-control projects	[44] 3,000,000	1,640,097	3,000,000
Improvement projects (works and measures)	4,000,000	17,086	
Total, flood control	[45] 7,000,000	1,657,183	[45] 3,000,000
Grand total, regular funds, Department of Agriculture (including reappropriations)	1,532,756,623	1,310,359,389	1,385,758,620
Deduct reappropriations included in foregoing:			
Eradicating tuberculosis and Bang's disease (Animal Industry)	−7,827,000		−4,000,000
Control of European fowl pest (Animal Industry)	−5,000		−5,000
Farm Tenant Act:			
Title I (tenancy loans)	−710,000		−575,000
Title III (submarginal land programs)	−8,213,000		−2,445,000
Loans, relief, and rural rehabilitation	−23,000,000		−17,700,000
Conservation and use of agricultural land resources	−155,000,000		−70,000,000
Sugar Act of 1937	−1,500,000		−16,000,000
Crop insurance	−25,500,000		−500,000
Total deductions, as above	−221,755,000		−111,225,000
Total, direct appropriations, regular funds	1,311,001,623	1,310,359,389	1,274,533,620

[32] Provided by Price Adjustment Act of 1938 (title V, act of June 21, 1938).
[33] Provided by Agricultural Appropriation Act, 1940.
[34] Includes $5,000,000 provided by Second Deficiency Appropriation Act, 1939.
[35] Authorized by Second Deficiency Appropriation Act, 1939.
[36] Includes $65,000,000 out of sec. 32 funds, fiscal year 1938, for cotton-price-adjustment program of 1937, as authorized by Third Deficiency Appropriation Act, 1937.
[37] The Commodity Credit Corporation was an independent Federal agency prior to July 1, 1939, on which date, pursuant to the Reorganization Act of 1939 and Reorganization Plan No. I, it was transferred to the Department of Agriculture. Expenses for administration are paid from the funds of the Corporation.
[38] $119,599,918 for restoration of the capital impairment of the Commodity Credit Corporation as of Mar. 31, 1939, was provided by Third Deficiency Appropriation Act, 1939; an appropriation of $94,285,405 was made for this purpose, fiscal year 1938.
[39] See table 6 for detailed statement of obligations, fiscal year 1939, under this group.
[40] The Rural Electrification Administration was an independent Federal agency prior to July 1, 1939; on which date, pursuant to the Reorganization Act of 1939 and Reorganization Plan No. II, it was transferred to the Department of Agriculture.
[41] Forest roads and trails shown under Special items.
[42] Obligated for highway research out of prior-year appropriations.
[43] The Bureau of Public Roads was transferred to the Federal Works Agency on July 1, 1939, pursuant to the Reorganization Act of 1939 and Reorganization Plan No. I.
[44] In addition, $175,733 was carried over from 1938 Appropriation.
[45] Provided by War Department Civil Appropriation Act.

TABLE 6.—*Obligations incurred under funds available for agricultural adjustment and related activities, fiscal year 1939*

Item	Obligations, 1939
Salaries and expenses, Agricultural Adjustment Administration:	
Agricultural Adjustment Administration:	
Administrative expenses	$1,095,657
International production control committees	17,500
Office of the Secretary	14,763
Office of the Solicitor	137,017
Library, Department of Agriculture	3,240
Extension Service	8,000
Bureau of Animal Industry: Marketing agreements with respect to hog cholera virus and serum	29,510
Bureau of Agricultural Economics	152,679
Agricultural Marketing Service	120,604
Office of Foreign Agricultural Relations	24,674
Total	1,603,644
Payments for agricultural adjustment: General program: Agricultural Adjustment Administration: Administrative expenses	263,956
Conservation and use of agricultural land resources:	
Conservation program:	
Agricultural Adjustment Administration:	
Administrative expenses	12,027,699
Conservation payments	459,870,121
Removal and diversion of agricultural surpluses	22,110,000
Office of the Secretary	321,496
Office of the Solicitor	124,126
Office of Information	10,680
Extension Service	66,000
Forest Service	46,528
Bureau of Agricultural Economics	360,037
Agricultural Marketing Service	198,854
Bureau of Standards	3,000
Division of Disbursement, Treasury Department	272,500
Office of the Treasurer, Treasury Department	89,950
General Accounting Office	397,509
Total	495,898,500
Regional research laboratories:	
Bureau of Agricultural Chemistry and Engineering	3,981,066
Office of Experiment Stations	6,313
Bureau of Plant Industry	3,339
Bureau of Agricultural Economics	4,780
Total	3,995,498
Adjustment in freight rates for farm products:	
Bureau of Agricultural Economics	$33,054
Agricultural Adjustment Administration (Division of Marketing and Marketing Agreements)	2,847
Conservation and use of agricultural land resources—Continued.	
Adjustment in freight rates for farm products—Continued.	
Office of the Solicitor	$11,731
Total	47,632
Total, conservation and use of agricultural land resources	499,941,630
Exportation and domestic consumption of agricultural commodities (Sec. 32, act of Aug. 24, 1935):	
Marketing and marketing agreements (A. A. A.):	
Agricultural Adjustment Administration:	
Removal of agricultural surpluses	13,441,422
Administrative expenses (A. A. A.)	731,932
Office of the Secretary	53,360
Office of the Solicitor	42,367
Federal Surplus Commodities Corporation:	
Purchases for relief	68,148,872
Administrative expenses	678,128
Total	83,096,081
Cotton price adjustment program of 1937:	
Agricultural Adjustment Administration:	
Adjustment payments	124,115,000
Division of Disbursement, Treasury Department	25,000
Total	[1] 124,140,000
Total, exportation and domestic consumption of agricultural commodities	[1] 207,236,081
Price Adjustment Act of 1938 (parity payments):	
Agricultural Adjustment Administration:	
Administrative expenses	833,752
Parity payments	28,136,121
Division of Disbursement, Treasury Department	25,000
General Accounting Office	5,127
Total	29,000,000
Retirement of cotton pool participation trust certificates:	
Agricultural Adjustment Administration:	
Administrative expenses	87,981
Retirement of certificates	1,103,514
Division of Disbursement, Treasury Department	11,620
Office of the Treasurer, Treasury Department	4,500
Total	1,207,615

[1] Includes $65,000,000, out of sec. 32 funds for fiscal year 1938, for payments in connection with the cotton price adjustment program of 1937, as authorized by the Third Deficiency Appropriation Act, 1937.

TABLE 6.—*Obligations incurred under funds available for agricultural adjustment and related activities, fiscal year 1939*—Continued

Item	Obligations, 1939	Item	Obligations, 1939
Administration of the Sugar Act of 1937:		Administration of the Federal Crop Insurance Act:	
Sugar Division:		Federal Crop Insurance Corporation:	
Administrative expenses	$137,961	Administrative and operating expenses	$3,236,268
Payments to producers	53,248,541	Subscription to capital stock, Federal Crop Insurance Corporation (Treasury Department)	[2] 5,000,000
Agricultural Adjustment Administration	444,047	Office of the Secretary	27,745
International production control committees	8,000	Office of the Solicitor	48,786
Office of the Secretary	15,293	Bureau of Agricultural Economics	51,300
Office of the Solicitor	30,068	Agricultural Marketing Service	24,693
Bureau of Agricultural Economics	10,898	Agricultural Adjustment Administration	1,403,306
Office of the Treasurer, Treasury Department	5,447	Total	[3] 9,792,098
Division of Disbursement, Treasury Department	15,750		
General Accounting Office	29,232		
Total	53,945,237	Grand total	802,990,261

[2] Amount requisitioned in 1939 under reappropriation of $20,000,000 for this purpose from unobligated balance of 1938 appropriation for conservation and use of agricultural land resources.

[3] Chargeable to reappropriations for 1939 from 1938 balances under conservation and use of agricultural land resources.

TABLE 7.—*Obligations under regular appropriations, fiscal year 1939, classified by types of activity*

Type of activity	All objects except payments to States, road funds, agricultural adjustment, and farm tenancy, rehabilitation, and related work [1]		Payments to States (for experiment stations, extension work, and special forestry activities) [2]	Farm tenancy, rehabilitation, and related work	Agricultural adjustment and related work	Road funds	Total	
	Amount	Percent					Amount	Percent
Research	[3] $19,638,083	18.91	[4] $6,541,250	[5] $1,001,826	[6] $4,071,491	$316,451	$31,569,101	2.41
Extension	1,563,813	1.51	[7] 17,917,583				19,481,396	1.49
Pest control or eradication	[8] 17,708,449	17.05					17,708,449	1.35
Regulatory work	13,523,568	13.02					13,523,568	1.03
Public-service activities	[9] 51,405,945	49.51	[10] 3,661,163				55,067,108	4.20
Farm tenancy, rehabilitation, and related work (exclusive of research)				[11] 222,433,814			222,433,814	16.97
Agricultural adjustment and related work (exclusive of research)					798,918,770		798,918,770	60.97
Road construction (exclusive of research)						150,000,000	150,000,000	11.45
Flood control (transfer from War Department)							1,657,183	.13
Total	103,839,858	100.00	28,119,996	223,435,640	802,990,261	150,316,451	1,310,359,389	100.00
Percentage of grand total	7.92		2.15	17.05	61.28	11.47	100.00	

[1] Includes ordinary activities, special items, and receipts and contributed funds not paid to States.

[2] Exclusive of payments to States from road funds ($135,000,000).

[3] Includes, in addition to $19,549,666 under ordinary activities, $31,515 under cooperative work, Forest Service, $15,775 under migratory bird conservation fund, and $41,127 under forest-fire cooperation (for forest taxation and timber insurance studies).

[4] Payments to States, Alaska, Hawaii, and Puerto Rico for agricultural experiment stations.

[5] For investigational work in connection with programs for land utilization and retirement of submarginal lands.

[6] Consists of $75,993 for investigative work incident to carrying out of the Federal Crop Insurance Act and $3,995,498 for operation of 4 regional research laboratories looking to the development of new uses and markets for farm commodities.

[7] Payments to States, Alaska, Hawaii, and Puerto Rico for cooperative agricultural extension work.

[8] Includes $9,080,225 for eradicating bovine tuberculosis and Bang's disease and $4,130,800 for control of emergency outbreaks of insect pests and plant diseases.

[9] Includes $21,407,713 for soil and moisture conservation operations, demonstrations, and information.

[10] Consists of $1,167,215 paid to States from national-forest receipts, $1,955,235 for cooperative forest-fire prevention, $99,826 for cooperative distribution of forest planting stock, and $426,611 for wild life restoration projects; and $11,245 paid to counties under Migratory Bird Conservation Act.

[11] Consists of $24,998,353 for farm tenancy loans and grants, $1,880,208 for liquidation and management of resettlement projects, $9,703,425 for land utilization and retirement of submarginal lands, $180,282,993 for loans, relief, and rural rehabilitation (provided by Emergency Relief Appropriation Act of 1938), and $5,568,835 under Farm Security Administration trust funds.

TABLE 8.—*Department of Agriculture regular funds allocated to research, fiscal years 1939 and 1940*

Bureau or activity	1939 (revised)	1940 (estimated)
Department proper:		
Office of Foreign Agricultural Relations	$177,000	$150,000
Weather Bureau	170,494	175,270
Bureau of Animal Industry	1,332,362	1,361,753
Bureau of Dairy Industry	680,521	692,500
Bureau of Plant Industry	5,052,317	5,183,009
Forest Service	2,124,849	2,208,966
Bureau of Agricultural Chemistry and Engineering	1,404,332	1,379,369
Bureau of Entomology and Plant Quarantine	2,267,471	2,225,396
Bureau of Biological Survey	467,032	
Bureau of Public Roads (highway research paid from Federal-aid funds)	316,451	
Bureau of Agricultural Economics	871,650	928,000
Agricultural Marketing Service	505,058	520,598
Bureau of Home Economics	303,000	325,085
Food and Drug Administration	124,745	153,000
Soil Conservation Service	1,652,877	1,673,185
Conservation and use of agricultural land resources (new uses and markets for farm commodities, regional laboratories, and surveys)	3,995,498	3,200,000
Farm Tenant Act (land utilization and retirement of submarginal lands)	1,001,826	973,500
Federal Crop Insurance Act	75,993	254,300
Cooperative farm forestry		25,000
Rural Electrification Administration		11,000
Office of Experiment Stations (exclusive of payments to States)	228,241	244,735
Special research fund (Bankhead-Jones Act of June 29, 1935)	1,365,935	1,400,000
Beltsville Agricultural Research Center	84,500	85,000
General department administration, including pro rata of publication, legal, and library work	825,699	1,018,961
Total	25,027,851	24,188,627
Payments to State and Territorial experiment stations for research under Hatch, Adams, Purnell, and Bankhead-Jones Acts	6,541,250	6,848,750
Grand total	31,569,101	31,037,377

TABLE 9.—*Detailed statement of emergency funds allocated to Department of Agriculture and of obligations incurred thereunder and from prior-year unobligated balances during the fiscal year 1939*

Appropriation title and project	Allocations	Obligations
National Industrial Recovery Act (June 16, 1933):		
Office of the Solicitor: Legal work in connection with land acquisition for wildlife refuges		$13,381
Bureau of Biological Survey: Acquisition and development of wildlife refuges		687,771
Total, National Industrial Recovery Act		701,152
Payments for agricultural adjustment (under allotments from $700,000 provided by Supplemental Appropriation Act, 1936, in substitution for Puerto Rico and Hawaii sugar trust funds, authorized by sec. 8, of Jones-Costigan Act of May 9, 1934):		
Puerto Rico:		
Office of Experiment Stations: Experiments in the propagation and breeding of tropical plants, and studies of parasites affecting domestic animals		1,952
Bureau of Entomology and Plant Quarantine: Insect-pest survey		102
Soil Conservation Service: Soil-erosion survey		6,600
Total, Puerto Rico		8,654
Hawaii:		
Office of Experiment Stations:		
Taro investigations		10
Liver fluke eradication		874
Development of truck farming and improvement of marketing facilities for farm products		14
Development of livestock feed		345
Development of tropical fruits and nuts		12
Promotion of the poultry industry		239
Bureau of Entomology and Plant Quarantine: Fruitfly control		737
Total, Hawaii		2,231
Total, payments for agricultural adjustment		10,885

TABLE 9.—*Detailed statement of emergency funds allocated to Department of Agriculture and of obligations incurred thereunder and from prior-year unobligated balances during the fiscal year 1939*—Continued

Appropriation title and project	Allocations	Obligations
Emergency Relief Appropriation Act of 1935 (Apr. 8, 1935):		
Office of the Solicitor: Title examination work in connection with forest and wildlife land acquisition		$7
Bureau of Entomology and Plant Quarantine:		
Brown-tail moth control		12
Citrus canker eradication		5
Gypsy moth control		107
Peach mosaic survey and eradication		201
Phony peach disease control		7
White pine blister rust control		368
Barberry eradication for prevention of black stem rust		1, 298
Dutch elm disease eradication		1, 864
Construction of insectaries, storage faciltites, etc		8
European corn borer survey		52
Locating and destroying wild cotton plants		446
Total, Bureau of Entomology and Plant Quarantine		4, 368
Farm Security Administration: Administrative expenses in connection with resettlement projects		5, 000
Total, Emergency Relief Appropriation Act of 1935		9, 375
Emergency Relief Appropriation Act of 1938 (June 21, 1938):		
Office of the Secretary: Departmental reserve	$185, 532	
Office of the Solicitor: Legal services in connection with loans, relief, and rural rehabilitation under sec. 1 (3), title I, Emergency Relief Appropriation Act of 1938	377, 885	339, 001
Office of Information:		
Informational work in connection with rehabilitation program of Farm Security Administration	5, 315	5, 283
Printing of standard forms	15, 000	13, 263
Total, Office of Information	20, 315	18, 546
Forest Service:		
Surveys and studies in control of forest fires and erosion, silvicultural investigations, and mapping and tracing national-forest boundaries	331, 445	325, 854
Eradication and control of rodents, insects, diseases, etc., on national forests	6, 511, 678	6, 417, 007
Administrative expenses	379, 320	372, 603
Total, Forest Service	7, 222, 443	7, 115, 464
Bureau of Agricultural Chemistry and Engineering:		
Physical improvements at Stoneville, Miss	3, 900	3, 898
Administrative expenses	10, 200	8, 085
Total, Bureau of Agricultural Chemistry and Engineering	14, 100	11, 983
Bureau of Entomology and Plant Quarantine:		
Citrus canker eradication	116, 666	97, 481
Gypsy moth control	945, 970	939, 391
Locating and removing peach mosaic	169, 622	129, 975
Phony peach disease control	307, 833	278, 144
White pine blister rust control	1, 824, 600	1, 779, 406
Barberry eradication for prevention of black stem rust	1. 219, 783	1, 203, 670
Locating and destroying *Thurberia* plants	83, 500	80, 073
Dutch elm disease eradication	2, 957, 500	2, 901, 507
Clearing quarantine building site at Hoboken, N. J	30, 000	24, 772
Administrative expenses	275, 000	251, 768
Total, Bureau of Entomology and Plant Quarantine	7, 930, 474	7, 686, 187
Bureau of Biological Survey:		
Development of wildlife refuges	1, 321, 786	1, 294, 786
Administrative expenses	82, 500	81, 298
Total, Bureau of Biological Survey	1, 404, 286	1, 376, 084
Bureau of Agricultural Economics:		
Preliminary surveys and economic research incident to programs for water conservation, and utilization	200, 000	153, 012
Administrative expenses	92, 300	80, 837
Total, Bureau of Agricultural Economics	292, 300	233, 849

TABLE 9.—*Detailed statement of emergency funds allocated to Department of Agriculture and of obligations incurred thereunder and from prior-year unobligated balances during the fiscal year 1939*—Continued

Appropriation title and project	Allocations	Obligations
Emergency Relief Appropriation Act of 1938 (June 21, 1938)—Continued.		
Bureau of Home Economics:		
Study of consumption of goods and services by rural and town families	$226,082	$225,802
Study of body measurements for garments and pattern sizes	315,442	314,409
Administrative expenses	110,000	110,000
Total, Bureau of Home Economics	651,524	650,211
Soil Conservation Service:		
National program of soil conservation, including control operations, erosion surveys, etc	9,841,669	9,052,225
Assistance to needy farmers in rehabilitation through construction of water facilities in arid and semi-arid areas	853,118	712,326
Soil conservation, statistical and research work	19,419	17,868
Administrative expenses	474,220	342,984
Total, Soil Conservation Service	11,188,426	10,125,403
Beltsville Agricultural Research Center:		
Physical improvement at Beltsville (Md.) Research Center	1,009,200	538,107
Administrative expenses	100,000	99,782
Total, Beltsville Agricultural Research Center	1,109,200	637,889
Agricultural Adjustment Administration:		
Compilation of data on standards, etc., for consumer goods	122,003	117,094
Administrative expenses	6,500	5,810
Total, Agricultural Adjustment Administration	128,503	122,904
Total, Emergency Relief Appropriation Act of 1938	30,524,988	28,317,521
Public Works Administration Appropriation Act of 1938 (June 21, 1938):		
Bureau of Agricultural Chemistry and Engineering: Physical improvements at Stoneville, Miss	15,100	15,097
Bureau of Entomology and Plant Quarantine: Construction of a plant and parasite receiving station at Hoboken, N. J	400,000	385,100
Soil Conservation Service: Construction of dams for storage of water, roads, buildings, fences, power lines, and other improvements in connection with land-utilization program under title III of the Farm Tenant Act	3,960,400	3,385,690
Beltsville Agricultural Research Center: Physical improvements at Beltsville (Md.) Research Center	3,492,671	1,677,190
Total, Public Works Administration Appropriation Act of 1938	7,868,171	5,463,077
Grand total, emergency funds	[1] 38,393,159	[1] 34,502,010

[1] Exclusive of funds provided directly to the Secretary of Agriculture by the Emergency Relief Appropriation Act of 1938 (for expenditure through Farm Security Administration) for loans, relief, and rural rehabilitation, and listed in this report under table 5 as a regular appropriation.

RECEIPTS FROM DEPARTMENT'S ACTIVITIES, 1939

Receipts accruing incident to the operations of the Department during the fiscal year 1939 totaled $49,666,379. This amount is classified into two groups, showing (1) miscellaneous collections and (2) repayment of loans made by the Farm Security Administration, as follows:

Miscellaneous collections:		
From business on the national forests:		
Timber sales	$2,853,294	
Grazing fees	1,548,437	
All other objects	470,702	
		$4,872,433
Contributions from private cooperators, appropriated as a trust fund (cooperative work, Forest Service) for various activities on the national forests and privately owned timberlands		944,444

Miscellaneous collections—Continued.		
Contributions from private cooperators for expenditure under trust arrangements:		
Farm Security Administration	$5, 267, 392	
Deposits of fees received from licensees under the Commodity Exchange Act	202	
Deposits in part payment of salaries of inspectors under the Sea Food Inspectors Act	78, 379	
Miscellaneous	526, 874	
		$5, 872, 847
From sale of hunting stamps (Migratory Bird Conservation Act)		1, 009, 008
From sale of products of migratory bird refuges, Migratory Bird Conservation Act		45, 214
From fees:		
Perishable Agricultural Commodities Act	$215, 057	
Alaska game laws	25, 501	
Naval stores grading	7, 539	
United States Warehouse Act	40, 620	
Miscellaneous fees	20, 849	
		309, 566
Reimbursement for services in inspecting agricultural products, miscellaneous refunds, etc		638, 086
Sale of Government property and products, payments for marketing privileges, and miscellaneous services		1, 680, 518
Miscellaneous		145, 877
Total, miscellaneous collections		15, 517, 993
Repayments of loans (Farm Security Administration):		
Principal repaid on loans		33, 353, 709
Interest collections on loans		794, 677
Total, repayments of loans		34, 148, 386
Total		49, 666, 379

DIVISION OF ACCOUNTS

The regional offices of the Division of Disbursement, Treasury Department, have cooperated in the semimonthly payment of the salaries and wages of approximately 47,750 field employees of the various bureaus, offices, and agencies of the Department. This represents an increase of 12 percent over the number paid by these disbursing officers during the preceding fiscal year. In addition, the facilities of regional disbursing officers were utilized more extensively for the payment of the administrative and program obligations of bureaus and agencies organized on a regional basis.

The Division of Accounts received from the Division of Bookkeeping and Warrants, Treasury Department, copies of 214 appropriation and transfer appropriation warrants, excluding those applicable to emergency relief appropriations. Approximately 200 letters of notification of receipt of warrants and 550 letters of notification of original and revised allotments approved by the Secretary were prepared and forwarded to the Department units concerned. In order to record obligation, expenditure, and collection transactions applicable to funds warranted and allotted during the year, as well as to those already available for obligation and expenditure, approximately 475 treasury cash accounts and 800 budgetary accounts were maintained. Allotting funds and revising allotments also entailed the preparation of approximately 500 memoranda to the Secretary.

To make the necessary disbursing funds available to the chief disbursing officer, Division of Disbursement, Treasury Department, for the payment of vouchers, pay rolls, settlements, etc., and to enable his regional disbursing officers in the continental United States, insular possessions, and Territories and the Department's temporary special disbursing agents stationed in foreign countries to make payment of the vouchers and pay rolls scheduled to them, 260 requisitions for disbursing funds and 1,970 requests for transfers of funds were prepared in or processed through the Division of Accounts, which placed $1,245,590,321 to the credit of these officers and agents.

The Division of Accounts examined and submitted to the Division of Disbursement, Treasury Department, Washington, D. C., for payment 130,345 schedules, listing 526,826 administratively approved vouchers and pay rolls; processed to offices within the Department 22,709 accomplished copies of schedules and 46,326 memorandum copies of vouchers and pay rolls applicable to payments effected by regional disbursing officers of the Division of Disbursement; received 12,653 claims from agencies of the Department, which, after examination and recording, were forwarded to the General Accounting Office for adjustment and direct settlement; received from the General Accounting Office, recorded, and forwarded to the appropriate offices within the Department 19,682 certificates of settlement, settlement certificates, and notices of disallowances of claims; received 15,107 schedules of collections from Department offices, accompanied by 92,405 remittances in the form of checks, drafts, money orders, and cash; and processed through the Division 986 schedules of transfers-special deposits, 5,757 schedules of adjustments, 2,518 schedules of voucher deductions, and 10,366 schedules of retirement and disability fund credits, involving credits to appropriation, fund, and receipt accounts of the Department totaling $6,520,656.

To provide for the recording of disbursements effected by disbursing officers and agents from appropriations and funds of the Department, and to provide information as to balances of appropriations and funds available with disbursing officers for the payment of vouchers, pay rolls, settlements, etc., the Division maintained 980 disbursing officers' disbursing cash accounts. The Division also maintained 662 disbursing officers' collection cash accounts in order to record collections deposited by disbursing officers or processed through their accounts and to provide information for the verification of collections covered into the Treasury or disbursed or transferred from special-deposit accounts.

The Division was required during 1939 to administratively examine 4,706 accounts current, or an average of 392 per month. These accounts pertained to disbursement and collection transactions effected by 39 disbursing officers and agents in 244 checking accounts. In connection with the administrative examination of accounts current, the Division received 78,828 daily and monthly summary statements of disbursements and collections by appropriation limitations from the Department as a whole. Of these, 8,604 monthly statements were examined, revised when necessary, and attached to the applicable accounts current for submittal to the General Accounting Office, in order to provide that Office with analyses of disbursements and collections by appropriation, subappropriation, limitation, receipt, and fund accounts.

Other activities conducted by the Division included the following: Maintenance of 200 general fund revenue accounts, in order to accumulate information as to collections received from the miscellaneous sources of revenue which were deposited into the Treasury; reception of copies of 895 transfer and counter warrants, necessitating the preparation of approximately 1,100 letters to Department offices notifying them of the issuance of these warrants; reception from the General Accounting Office of 3,644 notices of exception and their transmission to the proper Department offices for replies (3,527 replies to exceptions having been received, reviewed, recorded on the retained copies of the pertinent notices of exceptions, and forwarded to the Division of Disbursement, Treasury Department); and handling of 8,811 letters received from the General Accounting Office and from within the Department relating to claims receiving consideration in the General Accounting Office and 3,482 letters relating to check settlements.

The Division also processed appropriations aggregating $227,034,603 made to or transferred to the Department under the Emergency Relief Appropriation Act of 1938, as supplemented, reappropriations of $23,225,083 from funds made available under previous Emergency Relief Appropriation Acts, and recisions aggregating $4,955,785 from allocations received under the Emergency Relief Appropriation Acts of 1935, 1936, and 1937. The processing of these appropriations, reappropriations, and recisions required the preparation of numerous letters, statements, apportionments, etc., and considerable time and effort in contacting the Department offices concerned, the Bureau of the Budget, the Treasury Department, and the General Accounting Office. While no general ledger accounts were set up in connection with emergency relief appropriations, it was necessary to establish subsidiary records in connection therewith for control purposes. Complete records and files of all allocations were maintained for the purpose of checking project authorizations, allotments, adjustments, and recisions and for preparing various monthly reports and statements showing the status of such funds.

In addition, the Division received and initiated replies to numerous inquiries for various fiscal information; initiated requests for the issuance of appropriation, transfer appropriation, and transfer and counter warrants; initiated or examined requests on the General Accounting Office for corrections of errors in charging or crediting appropriations, funds, limitations, or official projects; examined and prepared for submittal to the Bureau of the Budget apportionments, and modifications thereof, of appropriations and funds, and reports of obligations incurred against the amounts apportioned; acted as the contact office between the Department and the Treasury Department, General Accounting Office, and Bureau of the Budget on numerous phases of fiscal work; reconciled appropriation, fund, and receipt accounts with the Treasury Department and the General Accounting Office; and assisted bureaus, offices, and agencies of the Department in reconciling their available cash accounts with the records of the General Accounting Office.

BUREAU ACCOUNTING SERVICE

This Division has continued to serve the Office of the Secretary, Department Library, Office of the Solicitor, Office of Information,

Office of Experiment Stations, Extension Service, Commodity Exchange Administration, and the Bureau of Home Economics in the administrative audit and accounting of their funds.

During the year the uniform property accountability records were adopted by several of the Bureaus and offices served by this Division. Procedures were outlined for classifying procurements and for recording additions and reductions and monthly reconciliation procedures were established. With the recent perfecting of adequate control over supplies inventory and now complete control over equipment, the Office of the Secretary has installed and placed in operation a complete system of proprietary accounts which will reflect a true financial balance sheet, exclusive of depreciation.

In connection with the receipt and deposit of registration fees and other charges, as provided for under section 8a (4) of the act approved June 15, 1936, amending the Grain Futures Act, $17,118 was received for deposit to the proper trust fund receipt account pending action on the applications. As all the applications have been favorably acted upon, the entire amount received has been earned and transferred to the general fund receipt account.

The act of February 16, 1938, authorizing the Secretary to establish, equip, and maintain four regional research laboratories materially increased the number of transactions under the bid and guarantee deposits account. During the year there was deposited to the bid and guarantee deposits account $152,980, which amount, added to the balance of $25,791 on hand from previous fiscal years, made a record total of $178,771 to be accounted for. Refunds to depositors amounted to $149,994, leaving a balance of $28,777 in the account for future disposition.

The above accounts, while fairly large and requiring considerable time and effort, are only a small portion of the work and amount of funds handled by the Collections and Deposits Unit. Collections from claims filed during the year or in the process of collection amounted to $1,114,918. Included in this amount are reimbursements to the Central Supply Section for general stores, photographic supplies, addressing, duplicating, and mailing materials, and for parcel post, foreign transportation and mail, ice, laundry, and motor-transport service charges.

To meet a very urgent need for a more effective functioning of the Bureau accounting service in the field of supplying administrative officers with the class of information which is essential for proper management and control, it was necessary to organize an Analysis and Reports Section. A fundamental weakness of a central accounting organization has been that the accounting work is so far removed from the general administrative area as to make the accounting organization to a material degree irresponsive to the demands of the administrators. To overcome this admitted weakness the Analysis and Reports Section was created and has made considerable progress during the year. In addition to the basic responsibilities of providing information essential to the performance of the management function peculiar to the several bureaus and offices served, there will be assigned to this section many other important tasks.

In addition to the expansion of the work of the Collection and Deposit Unit and the institution of the new Analysis and Reports Section, there was a considerable increase in the volume of work of

the transportation service unit, due in part to the increase of 25 percent in the number of yearly letters of authorization handled, and in part to the larger number of allotted funds, with many restrictions and limitations placed upon their use.

The cost of operating the Bureau accounting service during the fiscal year 1938 was 26 percent below the 1937 figure, and, with the adjustments made in the organization during the fiscal year 1939, it has been possible to handle the increased load and still reduce the operating cost below that for 1938 by $8,923. A summary of the work of this service is shown in tables 10, 11, and 12.

TABLE 10.—*Auditing, fiscal years 1936–39*

Fiscal year	Claims audited	Purchase orders pre-audited	Contracts audited	Items involved
	Number	*Number*	*Number*	*Number*
1936	93,056	10,492	856	1,189,442
1937	61,446	9,329	429	697,057
1938	41,201	8,860	210	414,542
1939	42,118	9,642	244	439,679

TABLE 11.—*Record of pay rolls and miscellaneous items, fiscal years 1936–39*

Fiscal year	Pay rolls prepared	Pay-roll items	Letters of authorization written	Collection claims filed	Transportation requests issued	Bills of lading issued
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
1936	40,033	591,416	6,994	298	13,874	17,499
1937	24,510	489,423	2,201	305	8,447	4,537
1938	9,564	251,276	1,435	1,361	11,554	2,930
1939	10,049	246,450	1,800	1,747	12,230	1,951

TABLE 12.—*Funds under direct and indirect accounting control of the Bureau accounting service, fiscal years 1937–39*

Item	1937	1938	1939
General expense appropriations and allotted funds	$8,485,410	$8,071,302	$7,876,493
Warranted to States	22,745,014	23,722,583	24,359,651
Offset by States	5,885,014	5,545,623	5,150,622
Supplemental State funds	5,959,276	7,940,276	8,997,579
Other funds	3,547,026	3,384,288	2,481,411
Total	46,621,740	48,664,072	48,865,756

DIVISION OF PURCHASE, SALES, AND TRAFFIC

The record of business transacted by the Division of Purchase, Sales, and Traffic during the fiscal years 1937, 1938, and 1939 is set out in table 13.

TABLE 13.—*Purchases, sales, and other activities of the Division of Purchase, Sales and Traffic, fiscal years 1937–39*

Item	1937	1938	1939
Bid Section:			
Bid transactions—number	8,223	6,282	6,025
Flow of bids:			
First quarter—percent	21	18	18
Second quarter—do	19	17	18
Third quarter—do	25	22	21
Fourth quarter—do	35	43	43
Bureau purchase orders approved—number	1,735	1,965	494
Aggregate amount—dollars	1,928,032	1,312,140	350,686
Forest-road contracts examined prior to approval by Secretary—number	92	62	87
Aggregate amount—dollars	6,080,090	4,890,162	5,219,425
Value of property in the District of Columbia transferred from one bureau to another in Department—dollars	3,654	11,027	10,101
Initial value of worn-out property transferred to Procurement Division, Treasury Department—dollars	31,034	87,827	67,394
Traffic Section:			
Freight routings furnished:			
Less than carload—number	13,489	11,629	17,486
Carload—do	2,941	1,892	4,962
Express routings furnished—do	8,946	6,117	6,550
Rates furnished:			
Freight—do	83,952	36,882	33,361
Express—do	3,506	1,357	1,034
Passenger, rail and water—do	6,860	10,595	13,429
Parcel post—do	1,189	726	104
Air, passenger—do	114	302	394
Itineraries furnished—do	2,267	5,517	6,872
Central Supply Section:			
Stock issues during year—dollars	866,488	710,226	696,704
Requisitions for stores, filled—number	43,353	38,909	36,690
Requisitions for printed forms, filled—do	[1] 25,000	[1] 28,000	[1] 27,000
Purchase orders (both to maintain stocks and for other activities)—number	39,340	20,450	23,450
Money value involved, all purchase orders—dollars	8,609,897	5,466,892	9,438,443
Average money value per purchase order—do	218	267	402
Experimental byproducts sold: For deposit to miscellaneous receipts—dollars	46,653	48,153	44,169

[1] Estimated.

GENERAL PROCUREMENT AND CONTRACT SERVICE

The fiscal year 1939 was marked by reassignment of functions and changes in organization which were departmental as well as interdepartmental in scope. On November 12, 1938, the Procurement Division, Treasury Department, recalled all waivers then in effect, under which several of the Department's bureaus were permitted to utilize bureau facilities in making purchases for W. P. A. projects, presumably because of a lessened demand for purchasing service on the part of other emergency relief activities. In January 1939 the Director of the Civilian Conservation Corps requested that the purchase of so-called heavy equipment payable from C. C. C. funds be transferred to the Procurement Division. Pursuant thereto a memorandum of understanding was executed on February 1, 1939, by representatives of the C. C. C., Procurement Division, Department of the Interior, and Department of Agriculture, in which "heavy equipment" was defined as any purchase of specified equipment involving a unit purchase price in excess of $500, and at the same time outlined the procedure to be followed. With respect to the Department of Agriculture, it was agreed that the Department's specifications would be employed in making procurements for C. C. C. activities under its direction. Also, during the course of the year the awarding authority of regional procurement officers of the Soil Conservation Service was

increased from $1,000 to $2,500 in order to better serve field requirements in connection with land-utilization functions initially exercised by the Resettlement Administration, later devolving upon the Farm Security Administration as the successor organization, and then in turn transferred to the Bureau of Agricultural Economics and the Soil Conservation Service.

PURCHASE SERVICE

The fiscal year 1939 was the seventh that the Central Supply Section has operated on a surcharge basis and, as in prior years, further refinements were effected, most significant of which was the development of maximum and minimum charges for single transactions, and for purposes of stabilizing operations long-range forecasts were made.

Analysis of purchase statistics disclosed that uniform application of percentage surcharges to the dollar value of orders resulted in an inequitable distribution of costs as between many small transactions and few large procurements. This is more obvious when it is pointed out that the transaction rather than dollar volume is the unit of work. To effect a more equitable distribution of the costs, maximum and minimum service charges were established. These charges were fixed on the basis that, when the current percentage surcharge was applied to a given transaction and produced less than 50 cents, the latter amount was used as the minimum charge. If, however, such application of the surcharge rate produced more than $50, the latter was used as the maximum charge. The income derived through this procedure remained substantially the same as in the case of the uniform application of the surcharge rate to dollar value regardless of amount. Statistics thus far gathered definitely indicate that the plan increased the aggregate charge for organizations with many small transactions but reduced the charges for organizations with transactions involving large dollar volume, thus distributing operating expenses more equitably on the basis of units of work.

The surcharge method of operation is intended to be sufficiently sensitive to react to conditions as they develop, but personnel procedures governing increase or decrease of the force do not possess the same degree of sensitiveness. It was found that employments could not be kept in harmony with short-time forecasts of probable work, for which reason annual forecasts based on averages for the prior 5 years were resorted to. The annual expense was similarly estimated and its percentage of the volume forecast was adopted as the surcharge rate. As was expected, there were certain months when the income produced by the surcharge so determined and applied in conjunction with the maximum-minimum plan was not sufficient to meet the expenses. However, the deficiency was more than offset by surpluses produced during other months. In fact, the dollar volume for the year far exceeded the forecast, and the surcharge rate for purchasing service reached a low of 0.05 percent for April.

Purchases of fertilizers, liming materials, and seeds for use as grant-of-aid materials increased very materially and composed about 57 percent of the Central Supply Section's total purchases. Because quantities and destinations are dependent upon farmers' participation in the conservation program, procurement problems of unusual complexity arose, but experience acquired in handling the initial but

moderate program in 1938 enabled the procurement work to keep pace with and facilitate the field operations.

It will be observed from table 13 that the total dollar value of purchases made during the fiscal year 1939 amounted to $9,438,443, whereas for the fiscal year 1938 the total was $5,466,892, from which it naturally follows that the percentage of expense to dollar volume decreased. This is illustrated by comparing the average rate of 0.45 percent for 1939 with 1.05 percent for 1938.

STORAGE AND ISSUE OF SUPPLIES

Storage and issue activities again remained reasonably constant but registered an apparent decrease in the volume of issue by comparison with the preceding year. In fact, the decrease reflected a change in procedure in that large paper requirements in the field were met by direct shipment from commercial contractors rather than from the central stocks in Washington. This not only effected a saving in destination costs but also relieved the paper situation in Washington.

The surcharge rate for storage and issue service averaged 6.9 percent while the comparable rate for the fiscal year 1938 was 7.9 percent.

Because of the close proximity of the central heating plant to the South Building, where the stock of the Central Supply Section is maintained, representatives of the Interior Department made arrangements to requisition materials for the plant's control laboratory from the Central Supply Section on a reimbursable basis. Although the total volume was small, it demonstrated the adaptability of the reimbursement surcharge method of operation.

In recognition of the principle that simplification of ordering procedures effects economies and promotes efficiency, particularly in organizations with a limited or no clerical staff, the Central Supply Section undertook the preparation of a loose-leaf illustrated stock catalog which will soon be ready for issue.

FREIGHT AND PASSENGER TRAFFIC SERVICE

There was a substantial increase in the total tonnage of freight movements for the Department, particularly in the carload category, which increased from 1,892 carloads in 1938 to 4,962 carloads in 1939. This large increase was due principally to heavy movements of fertilizers and liming materials used by the Agricultural Adjustment Administration in making grants of aid. There were also 17,486 less-than-carload movements, which represented approximately 5,000 additional carloads, thus making a total of approximately 10,000 carloads of freight for the year, exclusive of shipments that moved on a prepaid basis.

According to rough estimates, it takes approximately 20 minutes to compile a freight rate, which when applied to the number of freight rates secured by the Department during the year amounts to 1,480 man-days. Because of the time and cost entailed in the procurement of such rates, a more simplified method has been worked out in cooperation with the Procurement Division, Treasury Department, whereby during periods of high demand the Traffic Section of the Procurement Division details a rate man for part-time service in the Division of Purchase, Sales, and Traffic. Through joint study of the abstract sheets by purchasing and traffic personnel, it has been possible

to eliminate many unnecessary rates. Although the arrangement was operative only during the last 3 months of the fiscal year, its effectiveness has been definitely demonstrated.

In a further effort to expedite the handling of freight matters, offices of origin were authorized to use the Procurement Division Traffic Section form and serve the requirements of all interested parties through the medium of copies without transcription.

Maintenance of the passenger tariff files required the incorporation of 17,702 new or amended tariffs, but the availability of so comprehensive a file of passenger tariffs and other pertinent information has enabled the rendition of prompt itinerary service and effective assistance in adjusting post-audit exceptions in travel accounts.

COORDINATION AND CONTACT WORK

Changes in the Division's coordination and contact work embraced designation of the Chief of the Division as an ex-officio member of the technical advisory board, effective July 1, 1938.

The Associate Chief of Division was designated as one of the representatives of the Department to serve with an interdepartmental group in a study of information available in the several executive departments relating to specific instances of price fixing, etc., in Government procurements then under review by the National Economic Committee. This assignment was completed during the course of the year.

Secretary's Memorandum No. 819, dated May 12, 1939, transferred the functions of the Advisory Committee on Photogrammetry to the Technical Advisory Board, thus automatically discontinuing the subcommittee on specifications for aerial photography, of which the Associate Chief of Division was a member.

CHANGES IN DEPARTMENT REGULATIONS

During the year the following amendments to the regulations of the Department were approved by the Secretary:

Amendment No.	Title	affected No.
63	Contracts Covering Use of Equipment or Property Loaned or Rented to the Department	3318
64	Reduction in Force	2812
65	Leave Without Pay	2561
	Absence Without Permission	2562
66	Annual Leave, for Employees Assigned to Duty Within the Continental Limits of the United States	2511
67	Annual Leave, for Employees Assigned to Duty Outside the Continental Limits of the United States	2512
68	Sick Leave, for Employees Assigned to Duty Within the Continental Limits of the United States	2521
69	Sick Leave, for Employees Assigned to Duty Outside the Continental Limits of the United States	2522
70	Acquisition of Real Estate	1711
71	Acceptance of Voluntary Service Prohibited	2114
72	Deductions for Leave Without Pay	3216
	Pay for Sundays and Holidays	3217
73	Pulmonary Tuberculosis	1552
74	Operation of Elevators	1726
	Directory of Field Activities	1727
	Display of Flag on Buildings	1728

Amendment No.	Title	Regulation affected No.
75	Doubtful Claims Under Existing Appropriations or Appropriations, the Balances of Which Have Been Exhausted or Carried to the Surplus Fund	3165
	Claims of a Meritorious Nature or Containing Elements of Legal Liability or Equity	3166
76	Final Salary Payment	3213
77	Annual Report of the Secretary	1411
	Annual Reports of Chiefs of Bureau	1412
	Annual Reports Regarding the Construction of Rural Post Roads and National Forest Roads	1413
78	Annual Leave, for Employees Assigned to Duty Outside the Continental Limits of the United States	2512
79	Sick Leave, for Employees Assigned to Duty Outside the Continental Limits of the United States	2522
80	Periodical Investigation of Field Offices and Stations	2911
	Misconduct, Neglect of Duty, or Irregularities	2912
	Submission of Investigative Reports	2913
	Distribution and Use of Reports	2914
81	Disciplinary Action—Procedure	2921
	Suspension from Duty Without Pay During Investigation and for Other Reasons	2922
82	Typewriters, Adding Machines, etc	4122
	Vehicles, Tractors, Road Equipment and Boats and Parts, etc., Thereof	4123
	Scientific Apparatus and Laboratory Equipment	4124
	Surplus Documents and Books	4125
	Books and Periodicals	4126
83	Editorial Committee of the Journal of Agricultural Research	1345
	Purchase of Reprints from Outside Publications	1346
84	Purchase of Books, Periodicals, and Newspapers	4114
85	Distribution of Photographs	1216
86	Maps and Publications of Weather Bureau; Reproductions of Aerial or Other Photographs, Mosaics, and Maps	4425
87	Federal Taxes	3191
	State and Local Taxes	3192
88	Installation and Periodic Inspection of Boilers	1737
89	Furniture and Equipment	1731
90	Leases	1712
91	Long-Distance Telephone Calls	1674
92	Transportation of Effects on Permanent Change of Station	3451

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REPORT OF THE CHIEF OF THE FOOD AND DRUG ADMINISTRATION, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOOD AND DRUG ADMINISTRATION,
Washington, D. C., August 30, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the Food and Drug Administration for the fiscal year ended June 30, 1939.

Sincerely yours,

W. G. CAMPBELL, *Chief.*

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FOOD, DRUG, AND COSMETIC ACT

The Food, Drug, and Cosmetic Act of June 25, 1938, made instantly effective those provisions designed to protect the public against dangerous drugs, devices, and cosmetics; it granted authority to begin immediately the formulation of necessary regulations, including definitions and standards for foods, and continued in force the provisions of the act of 1906 until the new law became fully effective. As originally enacted, the statute was to become fully effective on June 25, 1939. An amendment approved June 23, 1939, however, postponed the new labeling provisions and certain other requirements until January 1, 1940, with authority under definitely specified and limiting conditions for additional postponements by the Secretary of Agriculture until July 1, 1940. No appropriation was made for the enforcement of the new act during the fiscal year other than a deficiency

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item of $15,000 in May for color-certification work. The Food, Drug, and Cosmetic Act, however, authorized the diversion of a part of the appropriation for the enforcement of the Food and Drugs Act of 1906 for the administration of the new law.

Work under the new law during the fiscal year 1939 included legal actions against dangerous drugs, devices, and cosmetics; the formulation of regulations for color certification and for prescribing definitions and standards for foods; and the review of applications filed in accordance with the new-drug section.

Legal actions during the year against allegedly dangerous drugs, devices, and cosmetics are summarized in table 1.

TABLE 1.—*Summary of interstate samples on which criminal prosecutions and seizures under Food, Drug, and Cosmetic Act were based during the fiscal year 1939*

Item	Criminal prosecutions	Seizures	Total
Dangerous drugs	30	45	75
Dangerous devices	0	57	57
Dangerous cosmetics	49	85	134
Total	79	187	266

First attention was directed to products, not previously subject to legal control, believed capable of producing serious public injury. Within 3 weeks after the approval of the act, interstate shipments of sight-destroying eyelash dyes containing paraphenylenediamine or related compounds were located, sampled, and analyzed, and seizures instituted. The objective was to drive such products off the market. Sixty-five seizures were made. Criminal prosecutions were directed against responsible shippers. Some of these actions have already been terminated with pleas of guilty and the imposition of fines by the courts. Seizures of eyelash dyes containing ammoniacal silver salts and pyrogallol also were made in the conviction that such products are dangerous to the eyes. The manufacturer of one of these products contested the action and a 3 weeks' trial resulted in a jury disagreement. This case will be retried. Other dangerous cosmetics leading to legal action during the year were skin-bleaching creams containing mercury compounds, lipsticks containing cadmium and selenium, and a mole remover consisting essentially of acetic and nitric acids. The work on cosmetics entailed the examination of 570 samples.

Among the drug products held to be adulterated because of their being dangerous to health when used in the dosage, or with the frequency or duration prescribed, recommended, or suggested in the labeling thereof, were products of the pain- and headache-reliever type containing such potent drugs as cinchophen, aminopyrine, barbituric acid derivatives, and combinations of bromides and acetanilid, and two obesity treatments containing desiccated thyroid. In one instance the manufacturer of an effervescent laxative by mistake substituted a poisonous substance, tartar emetic, for tartaric acid, for which the formula called. Reports of illness among users

of the article led to the apprehension of all intrastate shipments by State officers and to four Federal seizures. Criminal prosecution has been initiated. Under the act of 1906, action in an instance of this kind could have been instituted only upon a highly technical charge, if at all.

While most of the cases instituted under the new act have already terminated without contests, several manufacturers have indicated an intention of contesting the Government's charges and these cases will presumably be tried at an early date. Under the new act 868 samples were collected and analyzed in connection with the drug work.

Among the devices proceeded against under the new act, first mention should be made of the seizure of 37 shipments of lead nipple shields intended for use by nursing mothers. Medical evidence indicates that the use of these devices has resulted fatally to nursing infants through lead poisoning. The effort of the Administration's forces was to remove this article from the market wherever found. Approximately 2,171 boxes, each containing 1 pair of shields, were apprehended. Other types of devices against which action was taken were contrivances intended for nasal irrigation or the insufflation of medicaments into the nasal passages, so constructed as to be definitely dangerous to the user.

The new drug section of the act provides that no new drug shall be introduced in interstate commerce unless an application has been filed with the Secretary of Agriculture establishing that it is safe for use. This section was enacted as a safeguard against future tragedies like the Elixir Sulfanilamide disaster described in the previous annual report. Drug manufacturers began to file applications under this section of the act immediately after its passage. Between June 25, 1938, and June 30, 1939, 1,277 applications covering prospective new drugs were received. By the end of the fiscal year, 1,107 of these had been reviewed, 683 had been made effective, 376 were pending awaiting the submission of further information, and 48 had been withdrawn for further consideration by the applicants. The remaining 170 applications were received near the end of the year and are still under consideration.

Most of the new-drug applications describe new combinations of known drugs which will cause no direct public-health injury, although in many instances it is questionable whether they possess the therapeutic properties claimed for them. Applications covering this type of new drug are promptly reviewed from the standpoint of possible injury to health and are accepted as provided by the new-drug section without delay. Where there is an indication of possible misbranding under other sections of the law because of unjustifiable therapeutic claims, the prospective manufacturer is so informed. A few of the new drugs submitted are distinctly new and possibly highly valuable. On these, very deliberate consideration is essential to determine whether applications permitting interstate traffic may safely be made effective. The act places a serious responsibility upon the Administration; no valuable drug should be unnecessarily withheld from public use; the release of drugs without sufficient testing to establish their safety must be avoided. One application covering an important new drug called for a comprehensive review by medical

officers of the Food and Drug Administration of 2,000 case reports recording the experiences of approximately 100 physicians. The application was eventually made effective upon the condition that the distribution of the drug should be so controlled as to guarantee its use exclusively under medical supervision. The Administration's responsibility does not end when an application is made effective. Continued observation is essential to insure proper uses and the early discovery of any harmful results in actual medical practice which may require reconsideration of the decision to permit traffic in the drug.

Under the regulation-making authority of the new act in collaboration with the Solicitor's office and in many cases after public hearings, the following regulations were promulgated by the Secretary: Temporary regulations relating to new drugs and to sampling, July 22, 1938; temporary import regulations, August 15, 1938; general administrative regulations, December 23, 1938; final import regulations approved by the Secretary of the Treasury and the Secretary of Agriculture, promulgated April 8, 1939; regulations establishing a list of 132 coal-tar colors and their lakes, harmless and suitable for use in foods, drugs, and/or cosmetics, and a procedure for certification of such colors, May 4, 1939; canned shrimp regulations, June 12, 1939; amendments to the general regulations required by the amendment of June 23, 1939, issued June 27, 1939. On May 31, 1939, a tentative supplemental list of 31 coal-tar colors suitable for certification as such or in the form of lakes was announced for hearings to be held on July 5, 1939.

The promulgation of regulations prescribing definitions and standards for food products under the new statute has called for much detailed work. To facilitate standard-making operations, a standards committee was set up in the Food and Drug Administration, composed of four experienced State food-law-enforcement officials and two representatives of the Food and Drug Administration. This committee, in cooperation with the administrative officers of the Administration, determines what foods should be standardized, evaluates available data in support of a definition and standard, outlines to the field forces of the Administration additional data to be acquired, obtains the views of consumers and the trade, and eventually formulates tentative specifications for definitions and standards. These specifications are considered administratively by the Administration and with the aid of the Solicitor's office placed in proper form for announcement of a public hearing before a representative of the Secretary. The Secretary's representative, after hearing, makes a suggested finding of fact and formulates a suggested regulation, which are published for comment and criticism by interested parties. After ample time for such comment and criticism has been allowed, the entire record goes before the Secretary for the issuance of his order promulgating his findings of fact and a regulation prescribing a definition and standard, which are published in the Federal Register.

In anticipation of the standard-making activities of the next 2 years a Secretarial announcement was issued on February 15, 1939, in conformity with the act, exempting a number of foods having common or usual names from the requirement of label declaration

of ingredients for a period of 2 years pending the formulation, promulgation, and effective application of definitions and standards of identity. The list included breads; evaporated-milk products; malted milk; canned fruits and vegetables; a number of canned sea foods; sauerkraut; olives in brine; cheeses; oleomargarine; mayonnaise dressing; fruit preserves; sweet chocolate; sweet milk chocolate; and lemon, orange, and vanilla extract. Subsequently ice cream and frozen dessert were added to the list.

Proposed definitions and standards of identity were published and public hearings were held on the following: Tomato products, egg products, cream, concentrated milk, evaporated milk, sweetened condensed milk, dried skim milk, and 20 types of canned vegetables. Proposed definitions and standards of identity as well as standards of quality and/or fill of container were announced and hearings were held on the following canned products: Tomatoes, peaches, apricots, pears, cherries, peas, and dried peas. In most cases the presiding officers' suggested findings of fact were published before the end of the fiscal year.

In addition to these standards-making activities the standards committee and the technical force of the Administration have, during the year, collected much data which will eventually be made the basis of tentative standards on many types of fruit preserves, jellies, and fruit butters; on Cheddar, washed curd, Colby, and cream cheeses; on cacao products; and various bakery products.

An administrative conclusion of some moment was reached in connection with the section of the new act which defines a drug as misbranded if it is dangerous to health when used in the dosage or with the frequency or duration prescribed, recommended, or suggested in its labeling. This must be considered in conjunction with another provision which requires adequate directions for use and appropriate warnings against misuse. Many drugs of great value to the physician are dangerous in the hands of those unskilled in the uses of drugs. The statute obviously was not intended to deprive the medical profession of potent but valuable medicaments. The administrative conclusion was therefore announced that dangerous drugs like aminopyrine, cinchophen, neocinchophen, sulfanilamide, and related products may not be distributed for unrestricted use by the lay public without violating the statute; to insure compliance with the law, drugs of this character must be labeled with warnings so conspicuous as certainly to arrest attention and in such informative terms as will unfailingly apprise the user of the danger of irreparable injury if the drug is consumed without adequate and continuous medical supervision. Drug distributors have generally acquiesced in this decision, and there is evidence of sincere efforts to comply with its letter and spirit. There are types of drugs once used but now known to be unsafe for use even under medical supervision. Dinitrophenol as a slenderizing agent is one of these. The Administration has indicated its purpose to proceed against dinitrophenol when represented as a drug or for slenderizing purposes wherever found in interstate commerce, regardless of any label warnings that it may carry. Surveys of the market, however, have so far failed to reveal any traffic in this drug or the related poisonous compound, dinitrocresol, since June 25, 1938.

FOOD AND DRUGS ACT OF JUNE 30, 1906

ENFORCEMENT STATISTICS

The authorized diversion of a part of the funds for the enforcement of the act of 1906 for the administration of the Food, Drug, and Cosmetic Act is not proportionally reflected in the enforcement statistics under the old law. Since the new law removes the necessity of proving fraudulent intent in actions against medicinal preparations bearing exaggerated therapeutic claims, misbranded medicines of this type were given only limited attention during the latter part of the fiscal year in the belief that they could be more adequately dealt with after the new law became fully effective. With this exception, the tables which follow show no material reduction in legal actions as compared with 1938. Tables 2, 3, and 4 contain the usual data relating to seizures and criminal prosecutions, import actions, and samples collected and examined under the Food and Drugs Act of 1906.

TABLE 2.—*Summary of interstate samples on which criminal prosecutions and seizures were based during the fiscal years 1938 and 1939*

Item	Criminal prosecutions		Seizures		Total	
	1938	1939	1938	1939	1938	1939
Foods	330	319	1,538	1,599	1,868	1,918
Drugs	360	278	446	260	806	538
Stock feeds	36	29	8	2	44	31
Total	726	626	1,992	1,861	2,718	2,487

TABLE 3.—*Import shipments inspected at port laboratories during 1938 and 1939*

Item	Inspected and refused entry		Inspected and released		Total	
	1938	1939	1938	1939	1938	1939
Foods	1,763	1,647	27,478	32,273	29,241	33,920
Drugs	1,218	1,148	4,107	2,440	5,325	3,588
Total	2,981	2,795	31,585	34,713	34,566	37,508

TABLE 4.—*Number and kind of shipments inspected or sampled in 1938 and 1939*

Item	1938	1939	Item	1938	1939
Foods:			Drugs:		
Interstate samples	17,001	11,909	Interstate samples	9,354	5,610
Investigational samples	6,851	5,550	Investigational samples	353	325
Import shipments	29,241	33,920	Import shipments	5,325	3,588
Total	53,093	51,379	Total	15,032	9,523
			Total foods and drugs	68,125	60,902

These tables include no products dealt with under the new Food, Drug, and Cosmetic Act. The import data in tables 3 and 4 include about 21,400 shipments given only sufficient attention to determine that no sampling or analysis was required. The figures in table 4

under interstate and investigational food samples do not include inspections of about 204,000 cans of cream for buttermaking from interstate and intrastate sources, sampled in cooperation with State and municipal officials, or samples taken from more than 1,500 tons of condimental seeds imported for oil pressing. Attention was given under the Food and Drugs Act of 1906 to the output of 12,535 manufacturers and shippers located in the United States. Approximately 3,373 of these were involved in some form of adulteration or misbranding.

During the year 2,475 notices of judgment recording actions terminated in the courts under the Food and Drugs Act, numbered serially from 27926 to 30400, were issued. Of these notices, 1,971 related to food products, 475 to drugs, and 29 to animal feeds, involving a total of approximately 3,485 shipments.

TIME SPENT ON DIFFERENT TYPES OF VIOLATION

During the year 86.9 percent of the time of the Food and Drug field force was occupied with the control of interstate traffic and 13.1 percent with import business, figures almost identical with those of the preceding year.

Of the field time 25.2 percent was devoted to the drug project as compared with 33 percent in 1938. The reduction is attributable to the fact that no emergencies comparable to the Elixir Sulfanilamide and cancer-serum cases of 1938 occurred and to the adoption of the policy already mentioned of deferring action in the case of products bearing exaggerated therapeutic claims until the effective date of the new statute.

A decrease in the time allotted to the fruit work to 12.9 percent as compared with 14.8 in 1938 reflects the continued improvement in the spray-residue situation. Vegetable products required 7.2 percent in contrast with 8 last year. Fisheries products, including shellfish, which received 6.9 percent of the field time in 1938, required materially increased attention, amounting to 14.7 percent, because of objectionable conditions in the fresh-fish market. Dairy products received more attention, increasing from 7.9 percent in 1938 to 11.4 in 1939. This increase is the result of added attention given butter to detect shortages in weight and butterfat, and to the discovery in a limited section of the adulteration of butter with mineral oil. Somewhat increased attention, 4.8 percent of the field time as compared with 3.5 in 1938, was given to cereal products with a view to eliminating insect contamination in flour. Confectionery required 4.6 percent, approximately the same as last year. The remainder of the working time of the field was devoted to such miscellaneous commodities as soft drinks, chocolate products, eggs, flavors, nut products, oils and fats, and spices and condiments.

FOOD ADULTERATIONS INVOLVING PUBLIC HEALTH

Ninety-one seizures of fruits and vegetables bearing excessive spray residues were made as compared with 297 in 1938, and 125 in 1937. These were distributed as follows:

	Seizures		*Seizures*
Apples	73	Currants	1
Cherries	2	Pears	10
Crab apples	4	Cauliflower	1

Seizures of apples for excessive spray residues show a marked decrease as compared with 251 in 1938.

On September 19, 1938, the Secretary of Agriculture, upon the recommendation of the United States Public Health Service, announced a liberalization of the tolerance for lead in fruit products, increasing it from 0.018 to 0.025 grain per pound. The reduction in the number of seizures of fruit shipments apparently is not so much attributable to this liberalization of the tolerance as to a real decrease in the amount of fruit shipments bearing high spray residues. State authorities continued their efforts to control outgoing shipments and insisted on adequate cleansing of high-residue lots. One Eastern State which last year temporarily lost control of the situation exercised such excellent supervision that no high-residue shipments from that State were encountered.

Inspections of packing houses to determine the adequacy of washing facilities and knowledge about the effectiveness of State-control systems made it possible to collect fewer but more selective samples. The Administration's laboratories analyzed 2,191 samples of apples representing the output of 1,545 distributors, as compared with 5,465 samples from 3,814 distributors in 1938. Analyses by State authorities exceeded 75,000 samples.

The substitution of less toxic insecticides for arsenicals and fluorides practically eliminated the spray-residue problem as far as vegetables were concerned. Among the products checked for excessive spray residue which gave rise to trouble in previous years were celery, cauliflower, cabbage, asparagus, spinach, and green peppers. With the exception of one small area in a Western State, in which lead arsenate was used on cauliflower, no conditions warranting apprehension on the score of poisonous spray residues on interstate vegetable shipments were uncovered. The one consignment of cauliflower was seized.

Continued attention was given the presence of lead in food products from nonspray sources. Maple products were again the most serious offender, although material progress has been made by the industry in removing the source of lead contamination by the abandonment of lead-bearing utensils for collecting and concentrating the sap. The plan of the previous year was continued, including sampling at shipping points after delivery of carload lots for shipment. Analytical results were usually available before arrival of the shipments at destination. Where high lead was found, seizures were made. Approximately 300 official samples of maple products were analyzed, resulting in 46 seizures covering 3,146 drums. In 1938, 22 seizures, aggregating 1,089 drums, were made. Not all of the drums seized were high in lead. The practice of assembling drums of sirup from numerous producers to make up carload lots results in mixed shipments. Where some drums in a car are found adulterated it is necessary to libel the entire car, the burden of effecting segregation of the contaminated lots being placed upon the claimant.

In general, it is the practice of the ultimate packers of maple sirup who purchase from innumerable small producers to remove the lead from contaminated lots before further distribution. The law, however, grants the Government no authority to refrain from action against an adulterated product on the supposition that it will be

made legal by the receiver before further distribution. The Administration has considered itself under a definite obligation to apprehend interstate shipments of high-lead sirup and place them under court supervision until they are freed from lead. Therein lies a source of conflict with some engaged in the industry, who insist that the product should not be subjected to legal action until after the packing operations have been completed and the product is ready for ultimate distribution. They overlook the fact that consumers in the State in which the packer is located would be denied the protection which the Federal law guarantees in the event that the packer failed to purify the product.

During the year 76 lots of imported maple sirup, totaling 2,086,419 pounds, were examined and 49 lots, totaling 1,462,000 pounds, were detained because of excessive lead. One hundred and thirty-three lots of maple sugar, aggregating 6,005,063 pounds, also were inspected and 61 lots, totaling 1,404,000 pounds, detained.

The improvement noted in last year's report relative to lead contamination of imported sardines continued. Of 81 lots examined, only 5 small parcels were found actionable and detained. This shows a slight improvement over last year, when 18 lots were refused admission out of 229 lots inspected.

Extensive crab-meat inspections were continued in those areas where last year's operations revealed that further attention was needed. Conditions in the Atlanta station's territory, which includes the South Atlantic States, were reported last year as fairly satisfactory. This section required no especial attention in 1938. Many plants in the New Orleans station area and on Chesapeake Bay in the Baltimore station area were still open to serious criticism from the standpoint of sanitation. State authorities were, however, bringing increased pressure on these plants. The western district's limited crab-meat production showed no objectionable sanitary conditions. The record of regulatory activities shows that 150 packers were given attention. Fifty-nine seizures of polluted crab meat were instituted, representing the product of 28 packers. Last year 45 seizures, representing the output of 23 packers, were made. Criminal prosecution was recommended in the case of 5 shippers. Since the crab-meat season coincides with the beginning of the fiscal year, conditions as recited in this report relate to the summer of 1938. The seizures effected and criminal prosecutions terminated during the year with the imposition of financial penalties, coupled with an indication of the court's uncompromising intention to impose jail sentences for future offenses, have had their effect. Inspections made immediately after the close of the fiscal year and before this report was prepared have shown a very marked change for the better in the sanitary conditions of the industry in the Chesapeake Bay section.

FLOOD-DAMAGED FOODS AND DRUGS

Again, as in 1937, a major catastrophe required special policing of a large area to insure destruction of polluted foods and drugs. The disastrous hurricane and flood which visited Long Island and New England on September 21, 1938, imposed unusual demands on the New York and Boston stations. All available personnel from the Boston station, augmented by additional inspectors from New

York and Philadelphia, were deployed at strategic points in the inundated territory, to work in close cooperation with State and city authorities. Every effort was made to embargo damaged foods and drugs, to assist the authorities in the condemnation and destruction of all products that could not be made safe for consumption, to aid in setting up systems of salvage operations, to apprehend all shipments of flood-damaged products that moved out of the area contrary to embargo regulations, to locate all shipments in transit, especially perishable items held up on account of transportation difficulties, and to effect proper disposition of all objectionable items. Assisting in these operations was practically every health and police agency of Long Island, Massachusetts, Connecticut, and Rhode Island. Because under the emergency conditions prevailing accurate bookkeeping was impossible, no precise estimate of the extent of the damage done to food and drug products can be made. However, according to a conservative estimate, the goods condemned and destroyed in the Providence, Fall River, and New Bedford areas, where three-fourths of the damage was done, amounted to at least 1,800 tons of food products, including almost every variety of edible commodity.

FOOD POISONING

During the fiscal year 75 alleged food-poisoning outbreaks were investigated, primarily to determine whether the food believed to be involved was in any way violative of the Federal Food and Drugs Act. The outbreaks, involving 56 types of foodstuffs, occurred in 30 States and in 65 different communities. In general, the foods were uncooked or those usually eaten cold, such as salads, custard-filled pastries, cold meats, and cheese.

A total of 2,467 individuals was affected in the 75 outbreaks investigated. Of these, 26 died either from the consumption of contaminated food or because of complications arising from a previous condition. The symptoms in 66 outbreaks were loosely classified as those of gastroenteritis; 8 cases were reported as botulism; whereas in 1 outbreak the symptoms were those of mild discomfort characterized principally by extreme dryness of the mouth. The largest number of people affected in a single outbreak was 540, and the smallest number, 1. Six of the outbreaks resulted in the illness of groups ranging in size from 100 to 400 individuals. In the remaining outbreaks the victims comprised only the members of a family or a small party.

Where possible, samples were examined for the causative agents, but from 75 outbreaks investigated, samples were obtainable in only 35 cases. Definite laboratory evidence of food contamination was found in 12 of the 35 samples examined. In 6 samples the presence of chemicals, accidentally added to the food in its preparation, was demonstrated; in 5 evidence of contamination with organisms capable of causing food poisoning was obtained; and in samples obtained from 1 outbreak involving buckwheat flour an admixture of jimsonweed seeds was detected. In 3 outbreaks affecting 91 individuals enterotoxin-producing staphylococci were isolated; and from 2 outbreaks involving 2 individuals in 1 case and a single individual in the other, botulinus toxin was demonstrated in home-canned green

beans consumed in one instance, and in home-canned fried chicken which was eaten by the single victim in the other case. Except for the latter case, no deaths occurred in the outbreaks caused by bacterial contamination of food diagnosed by laboratory methods.

In 11 outbreaks in which 1,228 individuals suffered illness, toxicogenic staphylococci appeared to be, from an epidemiological standpoint, the causative agents, although laboratory proof is lacking because, in most cases, of inability to obtain proper samples. In addition to the botulism cases on which positive laboratory findings were obtained, 6 outbreaks investigated were accepted as authentic cases of botulism based on epidemiological and clinical evidence. Fatalities occurred in all 6 of these outbreaks. Underprocessed home-canned foods, namely, buffalo meat, peas, spinach, okra, peppergrass, and corn, appeared to be responsible for these cases. During the year there were no proven cases of botulism due to commercially canned foods.

Some of the cases reported as food poisoning were traced to other causes. One outbreak involving two children and resulting in their deaths was later learned to have been due to *Shigella paradysenteriae*, var. *Sonne*. Information eventually obtained regarding another case involving five individuals showed that the illnesses were caused by *S. paradysenteriae*, var. *Flexner*, and a third case which resulted in the death of a child was later reported to have been due to an enlarged thymus gland.

An outbreak due to jimsonweed seeds accidentally milled with buckwheat flour is of interest, since it involved a product in interstate commerce and investigations which followed the report of mild distress suffered by the members of 8 families, caused by a plant alkaloid in the jimsonweed, led to the seizure of 6 shipments totaling 3,600 pounds of flour and to the embargoing by the State of approximately 17,000 pounds on hand at the mill. With the exception of this outbreak, none of the cases investigated were found to be caused by food shipped in interstate commerce.

As has been stated, in 6 cases investigated the causative agent was found to be a chemical contamination of the food. A home-made cherry pie prepared with flour in which sodium fluoride had been accidentally mixed, resulted in 1 death; rat poison which, in some manner, was incorporated in thickening for gravy, resulted in the illness of 3 and the death of 1; similarly, gravy thickened with sodium fluoride caused the illness of 3 and the death of 1; and a roach powder containing sodium fluoride accidentally used for a baking powder caused the illness of 10 people and the death of 2 of them. The most extensive of the chemical poisonings was caused by contamination of "ponhaus" or scrapple (a product comprised of pork, cereal, and other ingredients) with arsenic. In this case, 100 persons were stricken when the ponhaus to which arsenic was inadvertently added in its preparation, was distributed throughout a small community.

Nitrites were involved in a reported food-poisoning case in which two persons died and one was made seriously ill following consumption of gumbo and rice. Analysis of these foods revealed the presence of both potassium and sodium nitrite but no sodium chloride. It appeared, therefore, that the nitrites had been used accidentally

in place of table salt. Careful investigation brought to light a jar containing a mixture of sodium and potassium nitrites which the surviving member of the family identified as the "table salt" used to flavor the gumbo and rice. The experiences of the year again emphasize the vital necessity of care in the home storage of poisons.

A review of the past few years' investigations of food-poisoning outbreaks indicates that approximately the same number of cases of botulism occur each year and that they are invariably caused by underprocessed home-canned foods. The major problems, however, are those outbreaks due to the toxicogenic staphylococci. These organisms were responsible for the great majority of the outbreaks investigated and affected the greatest number of people. The ubiquity of the staphylococci probably will continue to be responsible for making future investigations of food poisoning due to these organisms a major problem, unless reasonable care is taken in the selection of food, strict cleanliness in preparing it, thorough cooking, adequate refrigeration, and careful personnel supervision.

FOOD ADULTERATIONS INVOLVING FILTH AND DECOMPOSITION

More than 204,000 cans of cream for butter making from intrastate and interstate sources were examined by State and Federal officers working cooperatively. The contents of individual cans average approximately 8 gallons. About 3,400, or approximately 1.6 percent, were condemned. In 1938 of the 254,000 cans examined 6,957, or 2.7 percent, were condemned.

Five lots of Limburger cheese and one of Cheddar cheese were proceeded against because of the presence of insect fragments and filth. Two shipments of butter were seized on the same charge.

Tomato products again caused comparatively little difficulty from the standpoint of insect fragments or decomposition. Only 26 consignments including 16 of catsup, 2 of tomato juice, 4 of puree, and 4 of paste required seizure action. These represented the output of only 12 manufacturers, although attention was given to the products of 258 manufacturers of such products, and the examination of 830 samples. Criminal prosecution was initiated in the case of 6 manufacturers. Last year the products of 314 manufacturers of tomato products exclusive of canned tomatoes were surveyed; 31 seizures were made and 13 criminal prosecutions instituted.

Canned salmon production in 1938 amounted to 7,274,209 cases, of which 6,791,544 were packed in Alaska. During the packing season canneries both in Alaska and in the Columbia River section were patrolled by inspectors from the Seattle station. Alaskan inspections were made with the aid of airplanes which effected a material saving in time and permitted very much greater coverage than heretofore. In Alaska a total of 268 visits to 94 canneries was made. No bad fish were encountered during these inspections. This is to be ascribed to unusually favorable weather conditions during the packing season and an even flow of fish to the canneries throughout the season, both conditions favoring the efforts of the canners to put up a sound and legal pack. Attention was given to the products of 128 manufacturers with the examination of 843 samples. Only 9 lots, the output of 4 canners, were seized. Criminal prosecution was instituted against the packer responsible for 6 of the lots seized.

Contrasted with last year, when 7 shipments of domestically packed canned tuna were seized and 1 criminal prosecution was instituted, no actions were necessary against domestic canned tuna during the current year, although attention was given to the output of 24 canners, with the examination of 69 samples. This industry was long centered in southern California, where the bulk of the pack aggregating slightly more than 2½ million cases is produced. During the past year a tuna-canning industry of some size developed in the Seattle station territory, the fish canned being the albacore variety caught off the coast of Oregon and Washington. One hundred and ten thousand cases of northwest tuna were packed during the season.

Paralleling the supervision of the canned product, continuous attention is given to the raw fish brought to the canneries from foreign sources. The bulk of the tuna packed in southern California is caught in the waters extending from the latitude of Monterey, Calif., to the Equator, with relatively small quantities of fish from Japan and Costa Rica. The total volume of raw fish brought to the tuna canneries in southern California exceeded 137,000,000 pounds, of which 15,700,000 pounds were imported. Of the imported material 1,917,000 pounds were rejected by the Administration's inspectors because of decomposition. Total rejections, including condemnations of unfit fish by State cannery inspectors, the industry itself, and the imported material inspected by the Food and Drug Administration, aggregated 15,000,000 pounds. One hundred and twenty-one lots of imported canned tuna, totaling 1,330,000 pounds, were offered for entry, and 15 lots, aggregating 199,000 pounds, were detained because of decomposition. This compares with 132 lots, totaling 876,000 pounds, imported last year, of which 27 lots, amounting to 160,000 pounds, were detained.

As compared with last year when no action against canned mackerel was necessary, 3 lots from 3 different manufacturers were seized on a charge of decomposition. Fifteen mackerel-canning establishments were given attention and 46 samples examined.

Operations on fresh fish constituted a very important project of the Boston station and the ramifications involved activities by cooperating stations, not only in the East but also in the principal distributing centers of the Middle West as far west as Denver. Demand for a cheap type of fish has resulted in the development of a growing traffic in rose fish or "ocean perch," a type of deep-water soft-fleshed fish not previously used for food. The fish is sold in the form of frozen fillets. The edible flesh of these fish is quite commonly infested with parasites. In addition to this condition, many interstate consignments of this and other varieties of frozen fish were found in varying degrees of decomposition, presumably because they were held too long before being frozen. Two hundred and thirty-three consignments of fish or fish fillets, including ocean perch, cod, bass, haddock, whiting, pollack, and mackerel, were seized. In addition, 15 lots of parasitized tullibees and 1 of whitefish were seized.

Close inspection of imported tullibees and whitefish for parasitic infestation was continued. Three thousand three hundred and nine lots, totaling more than 10,350,000 pounds, were inspected and 181 lots, amounting to 547,000 pounds, were rejected. On a weight basis the proportion of rejections is slightly higher than last year, when

1,822 lots, amounting to 8,763,000 pounds, were inspected at the ports and 182 lots, or 426,000 pounds, were detained.

Continued attention to the fish-roe industry on Lake Michigan resulted in seizure of 13 shipments on charges of filth and decomposition, as compared with 26 in 1938. This product is employed in the preparation of so-called whitefish caviar, and in the case of some producers is packed under conditions which inevitably result in contamination. Continuous attention will be given this industry until the bad conditions are corrected. Attention was also given to the canned herring-roe industry which has developed in the Chesapeake Bay area. No shipments justifying legal action were encountered. A new industry, the distribution of unprocessed herring roe in containers similar to those employed for crab meat and oysters, is gaining a foothold in this same area. Because of the perishable nature of the product, adequate refrigeration is essential. One shipper marketed 400 pounds of this product in cardboard ice-cream containers. On arrival at destination it was found to be in a state of decomposition. Seizure was accomplished.

Fifteen lots of frozen shrimp and four of canned shrimp were seized because of decomposition, and criminal prosecutions inaugurated against three shippers. Importations of raw shrimp, principally from Mexico, also were inspected. Of 50 lots examined, totaling 3,500,000 pounds, 6 lots, amounting to 241,000 pounds, were excluded because of decomposition. Ten consignments of canned oysters adulterated with excess shell or because of decomposition also were seized.

Increasing importations of frozen rock lobster tails from South Africa called for the inspection of 162 lots, amounting to over 1,000,000 pounds, with detention because of decomposition of 39 lots, or 232,000 pounds. Thirteen additional lots, amounting to 120,000 pounds, no longer in an import status, were seized for the same reason. While the first importations of this article were found to be of satisfactory quality, the growing demand for the product led to the shipment to the United States of lots which had evidently been carelessly handled. As a result of investigations by representatives of the South African shippers who came to this country for the purpose, the detentions were acknowledged to be entirely warranted and protests previously lodged against detention were withdrawn. A marked improvement in later shipments indicates that corrective measures have been adopted.

The previous annual report discussed at length the causes of contamination in candy. Improper storage in the distributing market with exposure to insect and rodent attacks is the most common source of adulteration. Extensive seizures of consignments still subject to the jurisdiction of the Federal act, and vigorous action by local authorities in other cases have had a wholesome effect on the handling of candies in the distributing market. Criminal prosecutions with heavy fines have impressed on those few manufacturers who were accepting returned contaminated material for credit and remanufacturing it into low-grade candies that such practices are not only illegal but unprofitable. Two hundred and fifty-two seizures were made in 1939 as compared with 78 in 1938. The majority of the lots seized were small and involved goods that had obviously become contami-

nated after reaching the distributing market. The increased number of actions is caused by the fact that the project was in operation during the entire year and the inspectors had acquired experience in the way of locating those consignees most likely to store candy under improper conditions. Criminal prosecutions have been recommended in the case of 4 manufacturers who were responsible for 57 interstate shipments of adulterated candy.

Two hundred and five consignments of insect-infested flour were apprehended, as compared with 38 seizures in the previous year. The increased number of seizures, as in the case of candy, reflects the more thorough way in which the project was attacked and the fact that it was in progress during the entire season. The milling industry has approached this problem in a serious-minded way. In those sections where most of the seizures have been made the weather is characterized by hot, damp periods very favorable to insect development particularly where the goods are carelessly stored. To meet this problem there has been a tendency on the part of millers to ship in smaller lots which will not be held so long in the receiving markets. In practically all cases where seizure was necessary the adulteration had quite evidently developed in the distributing market.

The experiences with wheat flour have suggested a similar approach to corn meal and other cereals, and attention is now being given to such articles. Action was directed during 1939 against 35 consignments of miscellaneous cereal products including corn meal, grits, and breakfast cereals on a charge of insect or filth contamination.

The attention given to shelled peanuts consigned principally to peanut-butter manufacturers during 1938, which resulted in 11 seizures of dirty shelled peanuts, had a wholesome effect on the peanut industry. Direct interstate shipment of low-grade shelled peanuts for peanut-butter manufacturing has practically ceased, although there is still some truck traffic on the part of manufacturers themselves who buy and transport to their own peanut-butter factories. Only 2 lots of shelled peanuts were encountered justifying seizure. Four consignments of peanut butter showing evidence of having been made from filthy material also were libeled. Wormy or moldy conditions accounted for seizure of 52 additional consignments of nuts, principally Brazil nuts and California almonds. The soft-shell almond crop produced this year was especially wormy. Other nuts against which action was taken were piñon nuts, walnuts, cashews, and filberts.

A problem of considerable importance is the control of shipments from a few small pecan-shelling establishments operating under filthy conditions. Under the act of 1906 the Government is restricted to action against only such lots as can be shown by objective examination to be contaminated. Unfortunately the type of objective evidence necessary to prove the adulteration of these products cannot be obtained by any method of bacteriological examination as yet available. This is one of the practices in the food industry that it is believed can be controlled hereafter under that clause in the Food, Drug, and Cosmetic Act which holds a food to be adulterated if it has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth. As a result of the preliminary attention given this problem with a view to far

more extensive action as the new law becomes fully effective, two seizures were effected.

The usual attention was given to importations of various types of nuts. One thousand five hundred and forty-seven lots, aggregating 32,376,000 pounds, were examined, and 121 lots, amounting to 1,028,000 pounds detained, principally because of mold or insect infestation. By comparison, in 1938, 1,125 lots totaling more than 35,000,000 pounds were examined, of which 116 lots, or 1,680,000 pounds, were detained.

Importations of cocoa beans for the calendar year 1938 exceeded 453,000,000 pounds. During the fiscal year, 1,282 lots of imported cocoa beans, totaling 427,500,000 pounds, were inspected with detentions of but 32 lots, or 2,700,000 pounds, because of water damage and mold. The detentions represent but 0.6 percent of the amount inspected. Last year 938 importations were inspected, totaling 177,000,000 pounds, or nearly 30 percent of the total importations. Thirty-nine lots amounting to 1,376,000 pounds, or 0.77 percent, were detained. The improvement in the quality of imported cocoa beans recorded last year continues.

Condimental seeds as usual were inspected at the time of importation. The annual importation of spices and condimental seeds for the calendar year 1938 exceeded 121,000,000 pounds. A total of 2,455 lots was inspected during the fiscal year, amounting to just under 42,000,000 pounds, and 287 lots, amounting to 4,339,000 pounds, were rejected. As was the case last year, about one-third of the total importations in pounds was inspected and slightly more than 10 percent rejected as unfit for food purposes.

Eggs or egg products accounted during the year for 15 seizures and criminal prosecutions against 7 shippers. In all cases decomposition was the charge. Thirteen of the consignments seized were frozen whole eggs and two were egg albumen or whites.

Imported dates to the number of 335 lots, or 43,953,000 pounds, were inspected, with rejection of 55 lots totaling 4,483,000 pounds. Rejections therefore represented approximately 10 percent of the total poundage offered for importation, a considerable improvement over last year, when 31,600,000 pounds were inspected and nearly 6,000,000 pounds, or 19 percent, rejected. In the case of figs 297 lots totaling 4,423,000 pounds were inspected, with the detention of 19 lots totaling 199,000 pounds, or 4.5 percent. This represents a definite improvement over last year, when 5,913,000 pounds were inspected and 629,000 pounds, or 10.6 percent, were rejected.

Other food products against which action on a charge of filth or decomposition was directed include fresh and canned berries, dried fruits, dressed poultry, and canned fruits and vegetables.

FOOD VIOLATIONS INVOLVING ECONOMIC CHEATS

Space permits only the briefest discussion of food violations involving economic cheats. Increasing attention was given to butter because of the suspicion that violations of the legislative standard requiring an 80-percent butterfat content were on the increase. Short fat and short weight, the most common economic violations encountered in butter, led to 128 seizures covering the products of 86 manufacturers and the initiation of criminal prosecutions against

34 defendants. In 1938, 111 seizures against the output of 76 creameries were made and 30 shippers were prosecuted.

During the campaign on butter, one of the Administration's inspectors, working in a Middle Western State creamery, observed peculiarities in some of the cream receipts that excited his suspicion. Samples were found to consist of approximately 50 percent of mineral oil. An identical adulteration was discovered in 2 adjoining States where 3 individuals were found attempting to sell farmers and cream-station operators a formula "for increasing the Babcock reading," i. e., the butterfat test, by adding a certain amount of "fine oil" to the cream. The 3 individuals were arrested by State authorities and convicted in the State courts. The butter output of the 4 creameries that had received adulterated cream was sampled and revealed varying amounts of mineral oil, in some cases as high as 12 percent. Fourteen seizures were made, totaling 3,251 tubs, or 204,813 pounds, of butter. The claimants obtained court authority to test each individual tub. The tests revealed that 2,133 tubs, or 134,379 pounds, contained mineral oil. These were eventually required by court order to be denatured and rendered inedible. Seven hundred and fifty-one tubs, or 47,313 pounds, contained no mineral oil but were low in butterfat and were required to be reworked to bring them up to the standard. Of the entire amount seized only 367 tubs, or 23,121 pounds, were found to contain legal butter. Criminal prosecution of the 2 interstate shippers of adulterated cream has been recommended. Criminal action has also been directed against the creameries for shipment of substandard butter. To ascertain whether a widespread practice of adulteration with mineral oil or other foreign fats existed, more than 1,200 specimens of butter from as many different sources were analyzed. In no case, except butter from the sources already mentioned, was a foreign oil or fat discovered.

The development after extended research of a method for the detection of β-ionone, a powerful synthetic flavor, in reputedly genuine fruit flavors made possible a series of actions against these adulterated products. Seizures were made of the products of 5 manufacturers. The synthetic flavors used are harmless but replace the genuine flavor of enormous quantities of fruit. One pound of β-ionone costing about $4 has a flavoring strength equivalent to about 10 tons of black raspberries. The sale of these synthetic flavors under labels plainly announcing their artificial character would be entirely legitimate; their sale as genuine fruit flavors imposes on the buyer and denies the farmer a valuable outlet for his fruit. Nonalcoholic fruit-type beverages adulterated with synthetics, with water, sirup, or other foreign ingredients, led to 30 seizures against the products of 22 different shippers.

Among the products against which action was directed because of short weight were packaged tea, baked products, alimentary paste, salad oils, canned mackerel, and canned sardines. Adulteration of fresh oysters and scallops with excessive water accounted, respectively, for 5 and 12 seizures. Seven consignments of olive oil adulterated with other oils were apprehended. Criminal prosecution was instituted against 1 defendant responsible for 4 of these shipments. In 1 instance a consignment of oil sold as soya bean oil was found to consist of mineral oil. This also was seized.

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McNARY-MAPES AMENDMENT

Sixty seizures, as shown in table 5, were directed against canned foods which failed to meet the standards of quality, condition, or fill of container established under the McNary-Mapes amendment to the Food and Drugs Act and were not labeled to show their substandard character.

TABLE 5.—*Seizures of substandard canned foods in 1938 and 1939*

Canned food	1938	1939	Canned food	1938	1939
Cherries	47	35	Mixed apricots and pears	0	1
Peaches	4	0	Peas	57	13
Pears	1	1	Tomatoes	39	9
Apricots	4	1			
Mixed apricots and peaches	1	0	Total	153	60

The most common cause of action in the case of cherries was the presence of excessive pits; in apricots, undeclared water pack; in peas, overmaturity; and in tomatoes, poor color or low drained weight.

SEA-FOOD AMENDMENT

The inspection service authorized by the sea-food amendment was provided for 41 shrimp canneries in 1939 as compared with 51 in 1938, although 1 plant withdrew after 1½ months' inspection. A total of 1,085,829 standard cases were packed under inspection as compared with 1,181,423 in 1938.

An appropriation of $40,000 was made again to defray part of the costs of inspection. In addition, the packers paid $49,117.43, making the service cost, as heretofore, less than one-fifth of a cent per can.

One criminal prosecution terminated in a fine of $200 in the case of a canner who falsely labeled uninspected canned shrimp as packed under the supervision of the Food and Drug Administration.

ACTIONS ON DRUGS

As has been stated, a deliberate policy of temporarily reducing actions against misbranded nostrums was adopted awaiting the effective date of the new law which obviates the previous handicap of establishing fraud. Nevertheless, in the course of the year 33 seizures, involving the output of 31 shippers, were directed against misbranded proprietary medicines for human use; and criminal prosecutions were instituted against 26 defendants based on 120 different interstate shipments. This compares with 117 seizures against the products of 86 shippers and 45 criminal prosecutions in 1938. Consideration was given to the output of 432 manufacturers of proprietary remedies for human use with the examination of 471 samples.

One proprietary product made the subject of six uncontested seizures deserves particular mention. It consisted essentially of aminopyrine, hydroxyquinoline sulfonate, and salicylic ethyl ester carbonate. The article was labeled with a fanciful name followed by a complicated chemical name, "aminodimethylpyrazolon-quino-

linesulphonate," which purported to identify the ingredients. No lay user and probably few chemists or physicians would recognize that the first member of this hyphenated name is a chemical synonym for aminopyrine, a drug that has wrecked the health of many users. The label was highly deceptive in that the name used ignored the presence of the salicylic acid compound in the drug and deliberately concealed the presence of the dangerous ingredient, aminopyrine.

Misbranded veterinary remedies resulted in 10 seizures, the output of 9 shippers, and the institution of criminal prosecutions against 6 manufacturers in connection with 22 separate shipments as compared with 11 seizures and 15 criminal actions in 1938. A total of 114 veterinary remedies was collected, consideration being given to the products of 97 manufacturers.

Chemicals and preparations purporting to comply with the United States pharmacopoeial standards led to 45 seizures and the institution of criminal prosecution against 14 manufacturers, in contrast with 43 seizures and 13 criminal actions in 1938. The seizures effected do not include those directed against U. S. P. anesthetic ether, which will be reported separately. Exclusive of anesthetic ether the total number of crude drugs, chemicals, and chemical preparations purporting to be of pharmacopoeial quality collected and analyzed in the course of the year amounted to 1,414, the products of 378 manufacturers.

Two hundred and forty-one shipments of anesthetic ether were sampled, requiring the testing of 3,195 individual cans. The contents of 60 cans, or 1.9 percent, failed to meet the pharmacopoeial standard for anesthetic ether, resulting in the seizure of 4 consignments. Of 2,916 cans tested in 1938, 3.8 percent failed to conform with the standard.

Chemicals and chemical preparations purporting to be of National Formulary quality led to prosecutions against 11 manufacturers in connection with 13 different shipments. In addition, 2 seizures were made of purported National Formulary products, including 1 glandular preparation. In 1938, 7 criminal prosecutions and 2 seizures of glandular products resulted from the year's survey of National Formulary products. The record for 1939 shows the collection and examination of 888 National Formulary products, including 26 glandular products representing the output of 190 manufacturers.

Unofficial chemicals and preparations collected and examined in the course of the year amounted to 1,625, the products of 402 manufacturers. This resulted in 8 seizures, including 1 shipment of unofficial glandular preparations, and the institution of criminal prosecutions directed against 23 interstate shippers, as compared with 13 seizures and 8 criminal actions in 1938.

Other legal actions included seizure of 57 consignments of nonsterile absorbent cotton, cotton swabs, and dressings, representing the products of 24 manufacturers, and 11 of nonsterile sutures from 2 manufacturers. Last year 36 seizures of nonsterile cotton, cotton swabs, and dressings, and 1 of catgut sutures, the output of 21 manufacturers, were made. The campaign against worthless prophylactics begun last year with 181 seizures was continued, 75 seizures being made. Prosecution was also instituted against 2 manufacturers for

shipments of ineffective products represented as having antiseptic qualities.

BACTERIOLOGICAL STUDIES OF FOODS AND DRUGS

In addition to the food-poisoning investigations already referred to, the bacteriological unit examined bacteriologically, organoleptically, or both, a total of 949 domestic and import samples comprising 13,096 separate subdivisions. The samples examined embraced a wide variety of articles, including practically every type of product subject to regulation under the Food and Drugs Act, with sea foods, surgical dressings, absorbent cotton, sutures, and purportedly sterile ampuls predominating. One hundred and sixteen samples of sutures comprising 1,973 individual sutures representing 15 different types from 11 manufacturers were examined bacteriologically. As already reported, 11 shipments comprising the output of 2 manufacturers were seized as nonsterile. In general, the results of the suture examinations were gratifying, since the majority of the manufacturers are producing a sterile product.

Continued attention was given to the bacteriological condition of medicinal preparations in ampuls. One hundred and sixty samples, totaling 866 ampuls, were examined for sterility. More than 70 preparations from 28 domestic and 9 foreign manufacturers were represented. Seven lots of phenobarbital sodium in crystalline form, all prepared by 1 manufacturer, were found unsterile, resulting in 4 seizures, totaling 137 ampuls. One powdered preparation in ampuls and 1 liquid product, both of foreign manufacture, were found to contain living bacteria and entry was refused. All other lots of ampuls were found sterile.

One hundred and sixty-five samples of bandages, absorbent cotton, applicators, dental absorbents, and first-aid kits comprising 1,272 subdivisions, the output of 34 manufacturers, were examined. As already reported, 57 consignments from 24 shippers were seized.

In addition to the examination of routine regulatory samples extensive research for the purpose of improving and extending bacteriological methods for use in food-and-drug-enforcement work was continued in the unit.

VITAMIN TESTS

Further improvement in the quality of imported cod-liver oil is apparent. One hundred and ninety-nine shipments, representing 945,482 gallons, were assayed for vitamin D after sampling at the port of entry. Of the oils making claims for 85 U. S. P. units of vitamin D per gram, the minimum legal standard, only 2 shipments (2,940 gallons) were refused entry owing to vitamin D deficiency. Seven shipments (23,235 gallons), making claims for vitamin D in excess of 85 U. S. P. units per gram, were found to contain less vitamin D than claimed. The percentage of oils rejected was 2.8 as compared with 4.4 a year ago, and 32.1 in 1937. The examination of cod-liver-oil imports for vitamin A has been limited to spectrophotometric determinations owing to the impracticability of applying lengthy biological assays. Only 1 shipment was found to contain less vitamin A than claimed, and no oils were found with less than 600 units of vitamin A per gram, the minimum permitted for cod-liver oil.

The assay of interstate shipments of vitamin D carriers for poultry by the Association of Official Agricultural Chemists method, which involves the use of chicks, begun at the close of last year, included 98 samples. The majority of these were cod-liver oils, but assays were also made on other fish oils, fish, or fish-liver oils with vitamin A and D preparations added, and complex vitamin and mineral preparations. Twelve of these products were found to be deficient in vitamin D. These investigations have revealed that in some instances higher claims are being made for certain interstate shipments of cod-liver oil than were made for the same oil at the time of importation. In each instance these higher claims were found to be unwarranted. Although the quality of oil offered for entry is fairly satisfactory, and nearly all of the cod-liver oil used in this country is imported, complete protection of the purchaser is not provided by examination of cod-liver oils at the port of entry.

Two hundred and thirty-one biological assays were made on 172 official samples from interstate shipments of food and drug products. They include 32 U. S. P. assays for vitamin A, 74 U. S. P. assays for vitamin D, 98 Association of Official Agricultural Chemists assays for vitamin D, and 27 assays for vitamin B_1. Chemical determinations for vitamin C were made on 8 samples, and spectrophotometric determinations for vitamin A were made on 88 samples. These examinations showed 30 products, or 17.5 percent of the total, to be deficient in one or more of the vitamins.

Adulterated or misbranded vitamin products led to 12 seizures and criminal prosecutions against 3 shippers during the year.

PHARMACOLOGICAL INVESTIGATIONS

Routine biological assays were made on 376 drugs and drug preparations as shown in table 6.

TABLE 6.—*Biological assays of imported crude drugs and imported and domestic drug preparations, fiscal year 1939*

Article	Samples examined	Samples requiring detention	Article	Samples examined	Samples in violation
Imported crude drugs:			Domestic products:		
Aconite	7	0	Digitalis (crude)	6	0
Digitalis	13	1	Digitalis (drug preparation)	82	14
Ergot	37	4	Epinephrine	52	0
Strophanthus	3	0	Insulin (specialties)	6	0
			Squill	10	0
Total	60	5	Strophanthus	11	0
			Pituitary (posterior)	49	0
Imported drug preparations:			Pituitary (anterior)	8	2
Digitalis	4	1	Estrogenic preparations	45	12
Epinephrine	5	0	Corpus luteum	14	5
Ergot	1	0	Miscellaneous	2	0
Pituitary (posterior)	2	0			
Strophanthus	1	0	Total	285	33
Estrogenic preparations	17	6			
Miscellaneous glandular preparations	1	0			
Total	31	7			

Of 105 articles listed under the heading "digitalis" in the 3 subdivisions of the table, 19 represent the crude drug, 31 U. S. P. XI preparations, and 55 specialties such as ampuls, capsules, fluid-

extracts, pills, pulvules, and tablets. Twenty of the pharmacopoeial preparations were found to be of satisfactory quality. Seven seizures were made, and these as well as the actions taken on the other violative products listed in the tables have already been recorded among the totals under the drug section of this report.

Research investigations carried on in the Division of Pharmacology included studies of variations in the arginase activity in the livers of white rats caused by food variations, the toxicology of some glycols and their derivatives, the toxicity of the ortho-, meta-, and para-isomers of sulfanilamide, critical examinations of the various assay methods, studies of acute toxicity for the eye of paraphenylenediamine and silver salts, and an extensive investigation of coal-tar colors to determine their suitability for use in foods, drugs, or cosmetics under the certification provisions of the Food, Drug, and Cosmetic Act.

CERTIFICATION OF COAL-TAR COLORS

From July 1, 1938, to May 10, 1939, 1,348 batches of straight dyes, repacked dyes, and mixtures of coal-tar colors were certified for use in foods in accordance with the procedure set up under the act of 1906. These represented the output of 34 manufacturers and included 235 batches of straight dyes totaling 383,499 pounds, 970 batches of color mixtures totaling 354,538 pounds, and 143 repacked straight dyes totaling 36,955 pounds. Fourteen batches of color mixtures were refused certification because of failure to agree with the recorded formula, probably because of ununiform mixing.

Early in May legislative authority was granted for undertaking certification of colors suitable for use in foods, drugs, and cosmetics as provided under the Food, Drug, and Cosmetic Act. The new certification regulations became effective on May 9, and certification of colors under them began on May 11. The new regulations list 17 coal-tar colors certifiable for use generally in foods, drugs, and cosmetics, 53 for use only in drugs and cosmetics, and 13 for restricted use in such drugs and cosmetics as are applied externally only to portions of the body where they do not come in contact with the mucous membrane. No coal-tar color is certifiable for use in any article applied to the area of the eye. Straight drug and cosmetic colors are certifiable not only in the form of pure primary dye but also in the form of certain lakes, bringing the total number of dyes available for certification at the present time to 132.

Between May 11 and June 30, 1939, inclusive, certification was granted to 42 batches, totaling 70,755 pounds, of straight or primary dyes for use in coloring foods, drugs, and cosmetics. Twenty-four batches of repacked food, drug, and cosmetic colors, totaling 10,125 pounds, and 115 batches of food-color mixtures, totaling 55,471 pounds, were also certified.

During the same period certification was granted to drug and cosmetic colors, including those for external application only, in the case of 34 batches of straight dyes and 23 batches of lakes, totaling 21,371 pounds. Four batches of repacked drug and cosmetic colors, totaling 1,000 pounds, and 4 mixtures, totaling 850 pounds, were also certified. During the period between May 11 and June 30, 2 batches

of straight drug and cosmetic colors and 5 batches of mixtures were refused certification.

Color certification under the new law is rendered at the cost of the applicant. From May 11 to June 30 receipts from color-certification fees, amounting to $2,731, were turned into the United States Treasury as miscellaneous receipts.

MICROANALYTICAL STUDIES

The Microanalytical Division applies microscopic technique to problems of detecting adulteration in foods, drugs, and other commodities subject to the laws enforced by the Administration. No itemized report of samples examined in this Division is made, since these are included in totals given elsewhere in the report. The important contributions of the Division in the regulatory field should not be overlooked, however. Among the outstanding investigations conducted were a further study of the mold count of cream and butter as a measure of unfitness for food uses and studies of mold and insect infestation in a variety of food products not heretofore given extensive regulatory treatment.

CHEMICAL METHODS

Chemical researches in all technical units of the Administration have as their sole objective the development of better methods for the detection of adulterations. The Food Division developed refined methods for the estimation of fluorine, selenium, and arsenic in foods; studied ashing methods for the purpose of obviating errors in existing methods; continued its researches on chemical indices of decomposition in foods and on the identification of synthetic flavors; developed new or improved methods applicable to baked products and chocolate products; and in cooperation with the field prepared extensive experimental packs of canned foods and preserves for the purpose of procuring authentic data to be used in the enforcement of standards set up under the McNary-Mapes amendment and of formulating new definitions and standards under the Food, Drug, and Cosmetic Act.

The chemical unit of the Drug Division is performing similar services in the way of developing methods for the analysis of drugs.

COMMENTS ON COURT CASES

Reports received from district attorneys indicate that more than 200 criminal prosecutions for violations of the Food and Drugs Act of 1906 were terminated in the course of the year by pleas of guilty or nolo contendere, or by verdicts of guilty after trial. Fines ranging from as low as $5 to a maximum of $16,800 were imposed. In a number of instances the courts placed defendants on probation, and in at least one case the defendant was sentenced to 60 days in jail. The maximum financial penalty was imposed on the manufacturer and shipper of Elixir Sulfanilamide, the product responsible for approximately 107 deaths, as related in last year's report. Shipments of the poisonous "Elixir" were made from the manufacturer's plants in Bristol, Tenn., and Kansas City, Mo. Criminal prosecutions were in-

stituted in both jurisdictions. The Bristol case involved 112 counts and the Kansas City case 62 counts. Pleas of guilty were entered in both cases. In the first a fine of $16,800 was imposed and in the second a fine of $9,300, or a total of $26,100, the highest fine imposed against one manufacturer in the course of the entire enforcement of the Food and Drugs Act.

The jail sentence was imposed on the responsible head of a corporation distributing adulterated olive oil. On a plea of guilty the corporation was fined $1,200 and the individual $300 and the latter was remanded to jail for 60 days. Evidence was adduced that the offense was the second violation and that illegal practices had been resumed soon after the first conviction. Fines of $600 and $1,000 were imposed upon two of the firms mentioned in last year's report as being responsible for the interstate shipment of filthy candy.

A contested seizure involving 45 cases of Limburger cheese contaminated with insect fragments, tried before the court without a jury, resulted in a verdict for the Government. The claimant made much of the fact that the contamination was largely confined to the rind of the cheese. The Government introduced evidence that the rind of Limburger cheese is used as food. Comment by the court was to the effect that even if the interior of the cheese had not been infested his judgment would be the same, since the consumer has a right to expect cheese to be free from such noisome substances. He added that the question of injuriousness is of no moment; that a consumer has the right to assume a food to be free from filth and cannot be expected to examine a food with a microscope before eating it. Nine criminal prosecutions for the interstate shipment of filthy crab meat were terminated with penalties ranging from $40 to $175 and in 3 instances probation from 2 to 5 years. A criminal prosecution against a western tuna packer, involving 4 interstate shipments of canned tuna containing decomposed fish, tried before the court without a jury, resulted in a verdict of guilty with a fine of $800.

A strongly contested criminal prosecution against the manufacturer of a purported vitamin product bearing extravagant therapeutic claims was terminated by a jury verdict for the Government and a fine of $800 with costs amounting to approximately $1,800. The verdict has been appealed. The article consisted essentially of milk sugar, wheat starch, wheat bran, and epinephrine, and purported to contain vitamins A, B, C, D, E, F, and G. It claimed curative value for such ailments as Bright's disease, high blood pressure, low blood pressure, dropsy, toxic goiter, and heart disease. It contained no vitamin A, C, or D and only insignificant amounts of B and G. An action against the manufacturer of a misbranded veterinary remedy, also contested and tried without jury, terminated with a verdict of guilty and a fine of $1,950. This verdict was also appealed and the appeal was denied by the appellate court. One seizure against an herbal mixture was terminated early in the year by a verdict for the Government after trial before a court without jury. The article, which had mild laxative and diuretic properties, was labeled as "of unequalled value in all stomach, intestinal, and

blood disturbances." The court, in announcing its verdict, said in part:

> The makers of this nostrum engaged men more skillful in the use of the English language and they then prepared a sort of verbal Houdini act which evaded the spirit and the meaning of the law, and yet endeavored to purvey to the ignorant upon whom they preyed, the unsuspecting public, their nostrum. * * * I cannot conceive of any words more powerful than "of unequalled value." There is not any expression that I can think of that surpasses it in its all-embracing claim and promise, and instead of saying "diseases of the stomach, intestinal and digestive tract, and blood diseases," it says, "disturbances," a more euphonic expression. What can it be but a disease? It might mean cancer. It might mean ulcers of the stomach. It might mean the most virulent type of infection of the intestinal tract. It might mean a disease that called immediately for an emergency operation. * * * I would say the only established use for the predominant drug in this concoction is as a cathartic. Even a layman knows that if a person with a case of appendicitis which called for immediate operative relief took such a thing, the chances are certainly predominating that there would be a rupture and it is possible that there would be peritonitis, and with peritonitis the percentage of deaths is prevailing. So the broad and all-comprehensive nature of this language that includes every possible kind of disturbance, which means every conceivable kind of disease, the holding out to the public that there exists nothing in the world of equal value to this, I think is a misbranding that is malignant in its possible effect. It is certainly dangerous to the public and in direct violation of the act, the spirit of the act, and the wording of the act.

This decision has been appealed.

One criminal prosecution, which terminated early in the fiscal year with a plea of guilty and the imposition of a fine, was based on the shipment of a salve composed essentially of a lead compound in a fatty base. The case is cited as a curiosity. It bore labeling representing it as an effective treatment for frozen feet, eczema, mad-dog bite, inflammation of the eyes, blood poison, erysipelas, sore lungs and throat, cuts, sores, all kinds of injuries, rusty-nail sores, burns, boils or carbuncles, diphtheria, gunshot wounds, lame or sore back, caked or inflamed breast, sprained ankle, and mumps; and effective to take out and heal all inflammation; to prevent blood poison in man or beast; to heal cuts, wounds, and sores; to draw out all the pain, soreness, and lameness; and to heal sore throat.

INSECTICIDE ACT

During the year 2,577 samples of insecticides, fungicides, and disinfectants, involving the output of about 750 domestic manufacturers, were examined. Five hundred and forty-one of these products, or 21 percent, had never previously been encountered in interstate commerce. These included such materials as new synthetic organic compounds used in fly sprays, plant sprays, and disinfectants; copper preparations for use in fungicides; and wetting, spreading, and emulsifying agents used to make insecticidal sprays more effective. The properties of products of this character are often entirely unknown, and they require thorough testing, which must frequently extend over a considerable period to determine the validity of their label claims. In addition to these samples of domestic origin, 129 samples were collected from consignments offered for importation.

The samples are classified as follows:

Domestic:	*Samples*
Arsenate of calcium	92
Arsenate of lead (paste and powdered)	156
Paris green	32
Bordeaux mixture and combinations of bordeaux mixture with arsenicals	107
Lime-sulfur solution and sulfur preparations	222
Lubricating-oil-emulsion sprays	59
Miscellaneous insecticide and fungicide preparations for agricultural use	467
Preparations for the treatment of mange of animals	16
Preparations for lice and fleas on animals (including poultry), and for chicken mites	119
Sprays for houseflies and for the protection of animals against flies	144
Preparations for the control of clothes moths	242
Preparations for other household insects	297
Preparations for the control of ants	77
Disinfectants, germicides, and bactericides	318
Sodium hypochlorite disinfectants and related products	99
Miscellaneous and fraudulent preparations	130
Total	2,577
Imports	129
Total	2,706

One hundred and thirty-six of the domestic samples were made the basis of seizure or of criminal prosecution. Forty-four shipments, representing the products of 34 manufacturers, were seized, and criminal prosecution was recommended against 48 manufacturers. Twenty-three import shipments found in violation of the act were denied entry or detained pending correction of labeling.

AGRICULTURAL INSECTICIDES AND FUNGICIDES

Of the 609 samples of calcium arsenate, lead arsenate, paris green, and copper and sulfur fungicides analyzed, prosecutions were developed on 10 samples representing 3 manufacturers and a shipment of a product prepared by a fourth manufacturer was seized. The products involved were 2 lead arsenate samples, 1 calcium arsenate, 7 arsenical dusts, and 1 ammoniated copper spray. The lead arsenates were below the strength claimed, and both they and the calcium arsenate contained so much water-soluble arsenic that their use on foliage was unsafe. The other products were weaker than claimed. While past supervision has caused most of the products in this field to become well standardized, continued surveillance must be maintained. Faulty products would result not only in lack of control of the insects or diseases involved, but also in serious injury to crops by the spray.

Other plant dusts and sprays, although generally marketed in smaller parcels than the heavy agricultural insecticides and fungicides, constitute in the aggregate a very large amount. They are frequently complex mixtures, the effectiveness of which cannot be accurately predicted from their composition. Much actual testing work has been required to determine the truthfulness or falsity of the claims made for them. Prosecutions were developed on nine samples involving five manufacturers, and seizures were made of two products. The principal violations found were ineffectiveness of

the products and failure to give correctly the ingredient statement required by law.

The testing of copper preparations intended to replace bordeaux mixture with greater safety to the plants, and greater effectiveness has been continued. The amount of soluble copper necessary to protect against the diseases controllable by copper is very close to that which will cause injury to the host plant. In a number of cases the degree of safety or protection promised by the manufacturer was not found, and few, if any, have been shown to be generally superior to bordeaux mixture except for special purposes, as, for example, on tomatoes which are invariably affected by excess lime. Additional work on various types of formaldehyde dusts and dusts containing copper, as seed and soil treatments against damping off and other seed- and soil-borne diseases, has supplied sufficient information to evaluate the efficacy claims for many of these products. The labeling of a number of them has required revision.

HOUSEHOLD INSECTICIDES

Prosecutions or seizures were developed on 6 samples of ant preparations, 5 moth preparations, 3 housefly sprays, 5 roach preparations, and 16 general household insecticides, a total of 35, involving 23 different manufacturers.

There is very little information in the literature on the attractiveness of different types of poisoned baits to the different varieties of ants, with the exception of the Argentine ant. Extensive testing of these preparations has therefore been necessary. It has been found that relatively slight differences in the compositions of ant poisons, the presence of such substances as gelatin or oleic acid, or a variation in the form of sugar used, may make them unattractive to ants. Sugars attract ants in proportion to their sweetness. Milk sugar, which is not very sweet, fails to attract them at all. A few of the common varieties of ants definitely prefer greases and are only rarely attracted to sweetened poisons without an added fat.

As a result of the Insecticide Division's work on the analysis and testing of fly and moth preparations it is now possible to handle them more rapidly than in the past. The methods for testing mothproofing preparations that leave in the fiber of the article a residue which will protect it from future moth attack, have been published. The quality of fly and moth preparations on the market has been decidedly raised in recent years because of better methods of supervision, but new products are constantly appearing and continuous supervision is necessary.

Recently some of the mosquito repellents have been found to contain too little essential oil, such as oil of citronella, to be of practical value as a protection from these insects. A more thorough study of these products is necessary.

INSECTICIDES FOR USE ON ANIMALS

Sprays for use against flies attacking animals may be recommended for killing flies, for repelling certain varieties of flies, or for both purposes. A spray intended to kill flies must contain sufficient of the killing ingredient and be used in such a manner as to envelop the fly entirely; while one intended for repelling them must be used directly on the animal, and even under such conditions it cannot be

depended on for complete protection against flies. The claims for fly sprays for animals are frequently exaggerated, and in the case of 23 of the 50 samples tested it was found necessary to take action to correct misbranding.

Preparations for use against lice, fleas, and ticks on animals, including poultry, have also received supervision. These are better standardized than the fly sprays, but during the year information was developed on the basis of which prosecution was instituted in two cases and seizure in three, involving four manufacturers.

DISINFECTANTS

Disinfectants, germicides, and bactericides continue to be major sources of violation. Chlorine preparations deteriorate on standing, and as a result stocks are frequently found that do not have the strengths claimed. Sixteen samples collected resulted in seizure action. Certain coal-tar and pine-oil disinfectants have been found to be adulterated with mineral oil or to fall below the strength claimed. There has also been a considerable number of products recommended for sterilizing surgical instruments. This implies that the product will kill all germs, including bacterial spores. No known product is entirely satisfactory for sterilizing delicate instruments in short periods of time. Such claims are likely to be seriously misleading, and dependence on them may result in dangerous infections. During the year, 37 samples of disinfectants resulted in the development of prosecution cases against the shippers, and 29 samples in recommendations for seizures.

Tests are being made on formaldehyde fumigation of incubators to determine the dosage and conditions necessary for effective fumigation. Studies are also being made of required properties of bacteriological peptone for use in the media for disinfectant testing, with a view to obtaining a better understanding of the variations of results in the hands of different workers.

ANALYTICAL METHODS FOR INSECTICIDES AND FUNGICIDES

Improved methods for determining rotenone in derris and cube products and for determining thallous sulfate frequently used in poison ant baits have been published. The usual methods for determination of formaldehyde have not been found applicable in the case of some of the formaldehyde dusts used for seed and soil treatment. A satisfactory procedure has been devised. Collaborative work is being carried out on the determination of the pyrethrins in pyrethrum preparations, and progress is being made in the development of methods which will aid in identifying and determining the proportions of some of the newly developed synthetic insecticides in fly sprays and other insecticides.

CAUSTIC POISON ACT

Continuous routine attention was given to the caustic or corrosive chemicals required by the Federal Caustic Poison Act to bear precautionary labeling. Seizure or criminal actions were instituted in 15 instances in which the "Poison" label, antidote statement, or other required label information was omitted. Five of the products (camphor-phenol product, cresol, and toothache-treatment preparations)

contained more than 5 percent of carbolic acid; 2 (bleach ammonia used in beauty treatments and aqua ammonia U. S. P.) contained more than 5 percent of ammonia (NH_3); 3 beer-coil cleaning compounds contained more than 10 percent of sodium hydroxide; 1 drain-pipe opener consisted essentially of sodium hydroxide; 2 bowl cleaners consisting of sodium acid sulfate contained more than 10 percent of uncombined sulfuric acid; 1 silver nitrate ointment contained more than 5 percent of silver nitrate; 1 large shipment of lye seized had been damaged by fire in such a way as to obliterate the poison markings originally appearing on the cans.

Lye has a much wider distribution from the standpoint of home consumption than any of the other caustic or corrosive substances covered by the act. A routine inspection was made of labels used by manufacturers and distributors of lye on the many millions of cans sold annually and not a single label was found which did not bear the poison markings required by the Caustic Poison Act.

IMPORT MILK ACT

Entries of milk and cream subject to the Import Milk Act were confined to shipments from Canada. The number of permit holders was not increased, and because of economic or trade conditions some of the larger shippers were not so active as formerly in sending their output to the United States.

Necessary inspections were made of herds and producing establishments to assure that importations were obtained from animals in good health and handled under due sanitary precautions. No violations of the statute were detected.

TEA ACT

A total of 88,027,924 pounds of tea was examined, of which amount 43,822 pounds were rejected by the tea examiners. These rejections represented 0.05 percent of the total.

Of the tea examined, 69,051,322 pounds was fully fermented tea (black tea), 13,101,068 pounds was unfermented tea (green tea), and 5,694,497 pounds was semifermented tea (oolong tea). Tea of the mixed or variable type accounted for 181,037 pounds.

FILLED MILK ACT

Last year's report stated that only one manufacturer was producing filled milk for interstate sale. This firm operates plants in two States. Late in the current year two other firms, doing a limited interstate business, were discovered, and attention is now being given to their product. The principal manufacturer continues to ship the product in interstate traffic notwithstanding the continuous court action directed against the firm since 1934. Since the Filled Milk Act does not include a seizure provision, it has been impossible to check interstate traffic in this product during the pendency of the litigation.

The Filled Milk Act as passed in 1923 was not assigned to a specific department for enforcement. For approximately 9 years no legal actions were instituted under it. About 1933 the Department of Justice filed an information against the manufacturer just referred to alleging violation of the Filled Milk Act. This case terminated in

February 1934, when the district court held the law to be unconstitutional. Since the case had been instituted by information rather than through indictment the Government was unable to appeal the decision. At the request of the Department of Justice the Food and Drug Administration then collected and analyzed samples from new interstate shipments, submitting the data to the Department of Justice for appropriate action. This evidence was obtained in the fall of 1934 and an indictment procured in 1935. The district court again declared the act unconstitutional and the Government carried the case to the Supreme Court which, in a decision delivered April 25, 1938, overruled the district court and remanded the case to the Federal district court for trial. This case was tried in February 1939, and resulted in a jury verdict of guilty, a fine of $1,000 and costs being imposed. This verdict was appealed to the circuit court of appeals, and the judgment of the district court was affirmed in a decision of June 8, 1939.

While this litigation was in progress, Congress enacted an amendment to the Filled Milk Act, approved August 27, 1935, vesting the enforcement of the law in the Department of Agriculture. The Food and Drug Administration was given this duty. During the same period the manufacturer sought unsuccessfully to restrain the Government by injunction from the enforcement of the statute. This involved court proceedings in the District of Columbia. Meanwhile, the manufacturer changed the composition of his filled-milk product by adding vitamins to it. Contending that the modified product was a different article to which previous court decisions were not applicable, the manufacturer continued interstate shipments of the product. An indictment has been procured in one of the districts from which the manufacturer ships his product. A demurrer to the indictment has been filed by the manufacturer, and the demurrer will be argued in the early fall. As an outgrowth of this last indictment, the company filed a motion in the district court of the United States for the District of Columbia seeking a temporary restraining order to enjoin the Secretary of Agriculture and the Attorney General from prosecuting criminal proceedings and from instituting threatened proceedings of like nature in other jurisdictions. The motion for a temporary injunction was denied. The denying decision was affirmed by the Supreme Court upon appeal by the plaintiff. The injunction complaint was then returned for a hearing before a three-judge constitutional court in the District of Columbia on the merits of the appeal for a permanent injunction. Early in June 1939 the court ordered the bill dismissed.

NAVAL STORES ACT

REGULATORY WORK

During the year 66 firms and individuals engaged in the distribution of turpentine and thinners coming within the scope of the Naval Stores Act were given attention and 93 samples analyzed. Four samples, the products of 2 firms, resulted in prosecutions.

SERVICE WORK

Rosin inspection and grading services were rendered to 55 different naval stores producers or operators in the southern producing terri-

tory, the inspector visiting each of the stills where the work is done, on an average of once every 2 weeks. A total of 94,719 barrels and drums of rosin were inspected and marked, covered by 948 Federal Rosin Classification and Grade Certificates. Three lots of turpentine in drums, totaling 1,200 drums, were inspected, classified, and certified at the request of an exporting firm prior to shipment to Australia.

Seven samples of turpentine were submitted to the Washington laboratory by consumers and distributors, for analysis to determine purity and compliance with specifications, or to settle disputes over the acceptable quality or the kind of turpentine at hand. Two hundred and eighty-eight samples of turpentine, taken periodically during the year, were examined for the Commodity Credit Corporation, representing the contents of southern storage tanks in which this Government corporation holds stocks pledged as loan collateral, in order to guarantee the quality of the turpentine while it is held in storage. Samples from 29 lots of rosin were analyzed, classified, and graded in the Washington laboratory on request. Thirteen additional samples of rosin were examined and graded for the other Government departments and private concerns.

For services rendered and expenses incurred under the service section of the act, $7,044.97 was collected and transferred to the United States Treasury as miscellaneous receipts.

NAVAL STORES STANDARDS

Seven additional sets of duplicates of the United States rosin standards have been assembled. A total of 85 sets is now out on loan to inspectors, producers, dealers, and consumers. Ten sets of the standards were recalled, tested and checked for accuracy, completely overhauled and reassembled, and returned to the several depositories. Several sets of tentative turpentine color standards, made up by carefully blending turpentines of various colors, were prepared for the use of Federal and State inspectors of naval stores.

COLOR-MEASUREMENT AND TESTING

The design, construction, and testing of two types of instruments for laboratory grading of rosin, a photoelectric colorimeter and a visual wedge comparator, both based on sound physical principles, have been completed. Extensive tests on these instruments and comparison with the usual visual grading by two experienced observers show that (1) visual gradings by the two observers agree on the average to within 0.15 of a grade interval, (2) instrumental grading agrees with visual grading to within 0.14 of a grade interval, (3) photoelectric grading agrees with wedge comparator grading to within 0.08 of a grade interval, and (4) two photoelectric instruments agree with each other to within 0.05 of a grade interval.

Instrumental grading of rosin is therefore more precise than visual grading, and the instruments developed are valuable as laboratory tools for regulatory purposes.

NEW DIVISIONS ORGANIZED

In preparation for the enforcement of the Food, Drug, and Cosmetic Act, a Bacteriological Division and a Cosmetic Division were set up. Bacteriological work under the Food and Drugs Act has

heretofore been carried on by a unit of the Food Division and that under the Insecticide Act by a unit of the Insecticide Division. All bacteriologists in the Administration have now been assigned to the new division, and all bacteriological and related work will hereafter be carried on in it. The function of the Cosmetic Division will be to develop methods and consider the many technical problems expected to arise in connection with the control of cosmetics. For the time being, at least, this division will supervise the certification of coal-tar colors under the new statute. The chemical unit of the Drug Division has also been enlarged to provide a force of trained chemists qualified to develop new analytical methods for drugs.

A small museum has been set up in the Washington quarters of the Food and Drug Administration to meet a growing consumer demand for information about actions directed against foods, drugs, and cosmetics. This exhibit began with a collection of specimens procured more than 5 years ago to illustrate abuses in the food, drug, and cosmetic field not amenable to correction under existing law and intended to demonstrate the need for new legislation. With the passage of the Food, Drug, and Cosmetic Act, most of these displays have become obsolete and have been withdrawn. In their place displays have been assembled to illustrate visually the projects which are the subject of current regulatory activity. Although the exhibit is small it is attracting an increasing number of visitors. As a part of the same activity, small portable exhibits were sent upon invitation to 12 different conventions during the year.

COLLABORATION WITH AND SERVICE FOR OTHER GOVERNMENTAL AGENCIES

More than 2,500 samples of foods, drugs, insecticides, and related products were analyzed for other Government organizations under the legislative authority permitting such service upon a transfer of funds to cover the cost. In addition, 842 technical reports relating principally to the therapeutic or cosmetic value of various drugs, cosmetics, and devices were prepared.

In the cooperative work with the Post Office Department, reports were prepared in 254 cases and 666 analyses made. One hundred and seventy-six reports with 67 chemical analyses were made for the Federal Trade Commission.

In addition, 1,801 samples of foods, drugs, and insecticides were examined for other Government establishments. The largest number of samples was submitted by the Veterans' Administration, Federal Surplus Commodities Corporation, Department of the Interior, War Department, Treasury Department, Department of Justice, and Panama Railroad. Other establishments for which analyses were made included the United States Maritime Commission, Works Progress Administration, Department of Commerce, and the Bureaus of Agricultural Economics, Chemistry and Soils, Dairy Industry, and Entomology and Plant Quarantine.

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Report of the

CHIEF OF THE FOREST SERVICE

1939

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OF THE FOREST SERVICE

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U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1939

For sale by the Superintendent of Documents, Washington, D. C. - - - - - - - - - - Price 10 cents

Report of the Chief of the Forest Service

1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
Washington, D. C., October 1, 1939.

HON. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY:

In recent annual reports I have stated and restated the broad situation with respect to forest lands, which total one-third our land area.

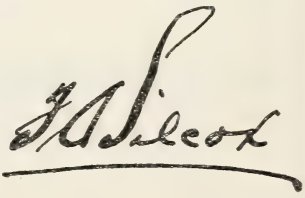
In last year's report I indicated that if without delay an adequate forest policy were adopted and action programs were started, there should be no excuse for a permanent timber shortage of national proportions. But I called attention to the serious situation in many regions already facing depletion of valuable species and grades. I emphasized the need to protect and manage forests we have. I urged growing more and better forests to provide employment, increase mass production power, balance the drain from usable forests with new growth in them, and make an investment in security for the Nation and its people whether or not markets for more forest products were in sight.

Three-fourths of all our commercial forest land is privately owned. It includes the most accessible and most easily logged land, and nearly three-fifths of our saw timber. It furnishes more than 95 percent of the timber we cut. Directly or indirectly it supports about one-tenth of our people. Most of it is not managed to yield continuous harvests. Most of the usable accessible virgin timber may be gone before enough usable second growth to meet our needs becomes available. As a Nation, we must find means to insure continuous harvests, and to close this gap.

This annual report appraises certain problems facing industrial and farm owners of forest land, and certain ways these problems may be solved. It indicates certain existing relationships between industrial and farm-forest owners, State and other Federal agencies, and the Forest Service. It briefs the role of community, State, and Federal ownership of forest land, and makes plain that Forest Service stewardship extends beyond the national forests.

My current annual report does not attempt to cover all things done, or all those that need doing, before the United States can be on sure ground with respect to its vast forest resource. Within practical limitations, this will be done in a special report to be submitted to the Joint Committee on Forestry. As you know, the President asked that this committee recommend to Congress legislative and other measures needed to help solve the country's forest problem.

Sincerely,



Chief.

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Introduction

NATURAL resources such as land, water, forests, forage, and minerals are sources of raw materials and other necessities of life, and of employment and income.

In the United States, forests are one of the more important natural resources. They help control floods, which take yearly tolls of human lives. They help prevent erosion and duststorms, which cause widespread human suffering. Protecting land, forests also rebuild worn-out soil. And they affect city people who manufacture and sell furniture, for example; stockholders and employees of carriers over which it is shipped; and farm people who depend on forests for such things as building materials, firewood, and fence posts.

Merchantable standing timber in the United States has been reduced by about 1,000 billion board feet since 1910. If this vanished timber were now available as growing stock it would be capable of producing on a continuous basis one-half as much saw timber annually as we cut during 1936.

Forests were abused in this process, and in earlier ones. Millions of acres were sorely depleted. We inherited our forests, but we have not even maintained them. Yet man can reproduce and grow forests. He can also harvest them repeatedly, and maintain and build them up. In these respects forests are unlike minerals.

Used, but managed this way, commercial forests act as permanent reservoirs for wood and work. They add to that social and economic security the desire for which motivates wage earners, business and professional men and women, agriculture and industry, local as well as State and Federal Governments. Forests become, then, a basis for better living.

This kind of managed use is a key to the present situation with respect to commercial forest land in the continental United States. Alaska excluded, this land totals 462 million acres. It has enormous present and potential values. Most of it is privately owned, but it performs many public services. In the aggregate, the value of those services exceeds private values. But most operators on private forest land do not practice this managed use.

As a Nation we would be better off with more rather than fewer forests. This is true whether or not markets for more forest products are in sight. But even today the drain from usable forests exceeds their growth, and current conditions indicate that most of

the remaining accessible virgin timber may be gone before enough usable second growth to meet real needs becomes available. And as a Nation we have not closed this gap, or insured continuous forest harvests.

This is a public obligation. It must be met. So must certain other public, and private, responsibilities and obligations that affect forests and forest land. The three-point program suggested in my annual report for 1938 indicates a way to do this. In brief, this program includes:

(1) Cooperation. Public aid has been extended to private owners of forest land for years. It has applied to fire protection, for example; to basic research, including the forest inventory and problems involving reforestation, forest economics, and forest management; to methods of manufacturing, processing, and using forest products; to ways of retaining old and developing new markets for them. It has also been applied to such problems as forest taxation, forest credits, and forest extension.

This public aid has been helpful. With it, and with many of the things private owners have done and for which they deserve credit, real progress has been made. Both public and private cooperation must be continued and extended if problems that affect private owners and the public welfare are to be solved successfully. But decades of experience indicates that cooperation alone cannot safeguard public interests and values involved in privately owned forest land. Nor can it protect private interests. Something more is needed.

(2) Public regulation of cutting practices on private forest land is necessary in order to protect public interests. With it private owners cannot, as the majority still do, nullify much of the effect of public aid in forest-fire protection, for example, by destructive cutting. With safeguards against bureaucratic action, public regulation will also safeguard interests of leaders among private forest-land owners who have now adopted forest practices better than those Nation-wide regulation might set; these private owners and others who may follow their example will then be protected against unfair competition from the majority that still operate on a cut-out-and-get-out basis.

The need for public regulation of cutting practices on privately owned forest land is now recognized, in part, by State legislation in Louisiana, New Hampshire, Idaho, and New Mexico. Practices of companies and individuals who operate on national forests, from which they harvested 1,290,561,000 feet of timber last year, have always been subject to public regulation. There is need for Nation-wide application of some form of public regulation to cutting practices on private forest land.

(3) Public ownership and management. Communities and States as well as the Federal Government should be adequately represented in public ownership and management of forest land. The degree to which this ownership and management may apply should be determined by the extent to which public interests are protected by private owners.

Privately Owned Forest Land

THREE-FOURTHS of all commercial forest land in the United States is privately owned. It helps protect the water resource and cultivated cropland. It includes the most accessible and easily logged land, nearly three-fifths of all remaining saw timber, possibly nine-tenths of the potential timber-growing capacity of the whole country. It furnishes more than 95 percent of the timber cut. Directly and indirectly it supports about one-tenth of a population of more than 130 million people. Some 202 million acres of commercial forest land are in industrial and nonfarm ownership. Farmers own 139 million acres.

Privately owned forests, and problems facing private owners, are major factors in the Nation's forest situation.

Problems Facing Most Private Owners

THERE are many problems that face most private owners of forest land. The basic one is that, in most regions and in the country as a whole, mill capacities are way above the power of accessible land to produce usable forests. This limits the time operations may continue at present levels. Another basic problem is the necessity to operate at a profit. It costs money to grow enough timber in time to keep operations going. This has never been done by most private owners. Instead, most profits have come from liquidation.

One problem is to protect forests from fires, insects, and diseases; another obvious one is to extend markets. This emphasizes the paradoxical situation of the tremendous need for new buildings and repairs on the one hand, and on the other of forest-industry plants that are operating at only about one-half their mechanical capacities. Forest taxation is a problem. So are tax delinquency, insurance, credits at low interest, freight rates, and research.

The following discussion is confined to certain problems that affect most private owners of forest land, and to certain measures that may help solve them.

Fire protection.—Without adequate fire protection existing forests may not be preserved, new forests may not be established or brought to harvest, forest land may not be kept productive, labor may not have forest and forest-industry jobs. The Federal Government cooperates through States, and they cooperate with private owners, largely because the public starts 75 percent or more of all forest fires.

Much of this cooperation has been through and with associations of private owners. Membership in these associations has often been on a voluntary basis. But all property owners in cities help pay for fire departments there. No city owner can refuse to pay taxes just because he thinks he may not have a fire. The present trend in the South, where most of the unprotected areas are located, is to organize fire protection on a county basis; to make assessments compulsory on all forest-land owners within the county; and to channelize all public funds through the State.

Last year cooperative forest-fire protection covered 308,458,000 acres in 40 States and Hawaii. The area burned on protected land was 2,623,270 acres. Damage was $7,179,630. Reported expenditures included $1,952,341 of private funds and $6,058,212 of public funds. Of the latter $4,322,011 was State and $1,736,201 was Federal. This Federal aid was greatly extended by construction of fire-control improvements and control of fires by the Civilian Conservation Corps on State and privately owned forest lands. Actual value of this C. C. C. work was about $17,000,000. It was a vital factor in cooperative forest fire protection.

But forest-fire protection is still a major problem. Nearly two-thirds of the 222,356 fires reported on all private and State-owned lands last year were on 161,948,570 acres outside organized protection districts. And results were spotty on many protected areas: excellent on some, but poor on others.

No successful solution of this problem is possible without increased funds. In addition to what the C. C. C. normally does, estimates indicate that $18,500,000 is needed annually. This is nearly $10,490,000 more than was spent last year. Parts of this increase are responsibilities of private owners and the States, but part of it is a Federal responsibility. Federal aid should be increased to $9,000,000 annually.

Protection from insects and diseases.—Losses from forest insects and diseases generally exceed those from fire. Blight has practically destroyed the once valuable American chestnut as a source of commercial forest products. Gypsy moths do serious damage among com-

mercial hardwoods in parts of the East. Between 1931 and 1935 western pine beetles killed 15 times as much ponderosa pine in Washington and Oregon as was destroyed by fire there. White pine blister rust is killing millions of seedlings and saplings and threatening commercially valuable sugar pine and western white pine in five Western States every year.

Like fires, forest insects and diseases do not respect State lines or property lines. Like fires, they should be discovered, attacked, and brought under control quickly. As with fires, work by the C. C. C. has been valuable, but adequate protection against forest insects and diseases requires more private, State, and Federal facilities and funds than normally are made available annually.

Markets.—The United States uses more than one-fourth of the wood that, in all forms, is consumed in all the world. Foreign markets for forest products are important, but they are and always have been small in relation to the domestic market.

Lumber accounts for about one-half of the wood used in the United States. In 1923 we consumed some 40,000,000,000 feet of it. In 1937 consumption was not far from 27,000,000,000 feet. This indicates the need for regaining old and developing new domestic markets. Without them our commercial forest resource cannot be used to its fullest extent.

Fortunately all analyses indicate that needs for lumber and other forest products are much greater than the quantity that has actually been used annually during the past decade. This is reflected in housing, including repairs and alterations. Four-fifths of our dwellings are of all-wood construction. It is reflected along 420,000 miles of railroad tracks resting on wooden cross ties that have been renewed at the rate of more than 50,000,000 a year; in mine supports that guard the lives of 750,000 miners; along nearly 90,000,000 miles of telephone and telegraph wires carried above ground on wooden poles. It is also reflected on most of our 6,800,000 farms; in upkeep of barns and other buildings there, and in 400,000,000 wooden fence posts that need replacing each year.

Most people think of wood in terms of such things as houses, furniture, boxes, and the like. And perhaps in terms of potash, charcoal, sawdust for circus rings, linoleum, telephone receivers, and phonograph records. But it also has a tremendously wider range of uses in physical and chemical forms. They already include movie films, for example, and lacquers, dyestuffs, distillates, and rayons; gas, alcohol, wood silk, and wood wool; toothpaste tubes, combs, and sausage skins.

In Europe, raw wood sugar is used for animals and humans. Fermented with yeast to form ethyl or grain alcohol, it may be used in

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place of gasoline. In the United States there is made a laminated substance that seems to stand somewhere between plywood and a true plastic. Still more or less a trade secret, apparently reliable reports claim that this material has been tested, as a one-piece airplane fuselage, for more than a year. According to reports, this material can be molded in a die, without high temperatures or enormous pressures, in less time than is needed to buckle on the present airplane's skin; it does not chip or corrode, resists water and acids, and in certain respects is stronger than aluminum alloy.

This substance is one of thousands of new uses for wood that researchers and technicians have developed. Yet with all the progress made, we have just scratched the surface. In chemical possibilities alone, wood still holds many secrets in its fibers, its cellulose, and its lignin.

Manufacturers and retailers and their associations have helped hold old markets for forest products, and develop new ones. So has the Forest Service, largely through its Forest Products Laboratory. All these efforts must be continued and intensified. But the problems of markets for forest products is part of the paradox of a whole economic system that, despite idle capital, huge manufacturing capacity, reserve labor, and an abundance of the necessities of life, seems unable to supply enough of these products to millions of needy people. A basic factor in this whole problem is low mass purchasing power. Some way must be found to raise it.

Foreign competition.—In 1938 the United States exported logs, hewed and sawed timbers, lumber, lath, shingles, paper, paper base, and articles manufactured from wood and paper that were valued at $93,398,607. But imports of these products were valued at $230,970,546.

The value of 1938 exports of wood pulp, pulp and paper-base stock, and articles manufactured from pulp stock and paper, included in these figures, was $37,567,962. The value of imports, also included, was $199,332,890. These imports, coming in free of duty, accounted for more than two-thirds of the wood pulp, pulp stock, and pulp products we consumed.

Thus foreign competition and domestic consumption have a bearing on our available supply of soft pulpable woods and the relation of them to world-wide pulpwood resources.

Even a brief survey of our soft pulpable wood resources in relation to world supplies brings out very clearly the need to conserve and build up our forest resources. Available reserves of such species as spruce, hemlock, and the pines are limited. Producing countries that export heavily, like Norway, Sweden, and Finland, cannot increase their pulpwood production very much without eating into their forest capital. This they are wisely loath to do. Mill capacities

in or directly tributary to eastern Canada are beyond the capacity of easily accessible forests to sustain, and immediate supplies are getting more remote. There is practically no commercial supply in the East or in Africa. There is little or none in South America or Australia.

The only world reserves of soft pulpable woods are in (1) the Union of Soviet Socialist Republics, (2) southeastern United States, and (3) a Northwest that includes British Columbia and Alaska. If, as competent observers believe, the Soviet Union must and will use practically all the wood pulp she can produce for the next two decades, any marked expansion in use elsewhere must come from the last two reserve supplies just mentioned.

World production of wood pulp was 16,719,000 short tons in 1931. In 1937 it was 26,121,000 short tons. This increase, more than 56 percent in 6 years, emphasizes the need for adequate management of all forests that supply pulpwood. An increase of nearly 50 percent in domestic production of pulp in the last 6 years emphasizes the need for management of pulpable forests in the United States. So does the fact that in addition to 40 or more pulp mills, of which 10 of the largest have been installed during the last 5 or 6 years, there are more than 10,000 sawmills and other wood-using industries that also depend on southern forests for raw-material supplies.

Of our own reserves, southeastern Alaska has enough soft pulpable woods, mainly hemlock and spruce, to provide continuous production for seven mills with a daily capacity of 500 tons each. Our northwestern forests grow rapidly. So do those in the South, where pulp developments provide a market for forest thinnings that make increased growth possible. The pulp industry there can use wood that is of relatively little value for lumber. Most of its production is now confined to kraft, wrapping paper, paper cartons, and the like, but a new plant at Lufkin, Tex., plans to produce wood pulp for newsprint.

If fire prevention and sustained-yield forest management become general with pulp and other forest industries, if their requirements and those of the many other forest industries are coordinated, and if growing stock in the South is built up, the South and the West may be able to count on continuous harvests of more pulpwood than is indicated by the planned capacity of existing pulp mills there. As a Nation we may then have a margin for export.

It may be necessary to import forest products so that foreign nations can pay for American-made automobiles and other things we export to them. Despite conditions cited, it even may be necessary to import free of duty wood pulp manufactured in northern Europe with wages that average about 30 cents an hour compared to wages that average 82.6 cents an hour in Oregon and Washing-

ton—pulp that, because of wage and other costs of American bottoms and without taking depreciated currencies into account, European manufacturers can ship to our Atlantic seaboard for around $3.50 per ton less than shipments can be made to that seaboard from Puget Sound and Columbia River points. For foreign competition is complicated and far-reaching. Besides hundreds of thousands of raw and manufactured articles, it involves such things as exchange rates, depreciated currencies, wage scales, and international relations.

Freight rates.—One-third of all our saw timber is on 6 percent of our commercial forest land. This land and timber are in western Oregon and Washington. Forests there include most of the remaining accessible virgin old growth. This virgin old growth is going faster than usable second growth sufficient to meet real needs is coming on. The East, with three-fourths of the land and four-fifths of the people, has less than one-third of the commercial saw timber. Many of its regions and localities already face forest depletion with respect to valuable species and grades.

Railroad freight on lumber from west coast points to Chicago costs around $20 per 1,000 feet. Freight by water from the West to east coast markets by way of Panama Canal costs around $14 per 1,000 feet. In 1936 transcontinental hauls of forest products included 4,344,218,000 feet of lumber that originated in Pacific Coast and Rocky Mountain States. This was equivalent to more than 173,700 carloads. It was 19 percent of all our domestic lumber shipments that year. Other long-haul shipments of lumber, including those from the South and Southeast to Midwest and Lakes and Northeastern States, totaled 4,694,568,000 feet. This was 20.5 percent of all our domestic lumber shipments that year.

Regional depletion has developed long and expensive freight hauls. It has been accompanied by waste in the woods, particularly of species and grades that, with lower selling prices, cannot be shipped over long hauls at a profit. The problem is serious to consumers, for incomes of all salaried people and wage earners make up, in the aggregate, 65 percent of the national income. Lumber and other forest products have become luxuries to many of these people. This has had widespread adverse effect on markets (p. 6).

Action to rebuild, restore, and manage the basic resource on forest lands tributary to heavy centers of population and demand offers one solution to this problem. Most of these lands are privately owned. Many of them are now in such condition that they do not offer attractive immediate returns for private capital. Most private owners are doing little or nothing with these lands. The existing set-up does not permit use of relief labor for much of the work that is necessary.

There is need for a device that will make it possible for the Federal Government to employ labor and, with adequate safeguards,

restore these and other forest lands to productivity, and manage them. This might be done through such unemployment relief and certain other Federal funds as may be available. Annual rentals might be paid to owners, and they might retain title to their lands. Recapture of all or part of the monies expended might be accomplished from use of the land and sales of its products.

Research.—Most industries know that real money spent for basic research develops new products and methods, betters old ones, and helps do better jobs than could be done by trial-and-error methods.

Some large forest-products corporations and their associations conduct forest research. But there are about 3,500,000 farmers who own commercial forest land in the United States. It is out of the question for them, and for most of the 1,000,000 industrial and nonfarm owners, to conduct the forest research they need. And research is essential to public management of community, State, and Federal forests.

Research by the Forest Service is primarily concerned with:

1. Uses of forest land and methods of growing timber. These require knowledge of climates, which vary from arctic to tropical; knowledge of effects of climate and wide ranges of soil and topography on several hundreds of tree species occurring in an infinite variety of combinations; and knowledge of such things as planting and fire protection.

2. Methods of cutting and removing forest-land crops with the least waste and a minimum of damage, on a basis of permanent production.

3. Methods of processing and using raw wood and its products and byproducts. This includes knowledge of strength and other physical, mechanical, and chemical properties of wood; of present and potential markets, particularly with respect to large volumes of low-grade material now being produced; of new uses for woods now used and those not now used; of how lumber and other forest products may be manufactured and processed best.

4. Economic aspects of managing forest land; of harvesting its resources; and of manufacturing and processing, distributing, and using them. This includes such things as forest taxation; tax delinquency; forest-fire insurance; stumpage, log, and lumber prices; where our forests are, how fast they are being depleted, how fast they are growing, how fast they can be expected to grow, and present and prospective requirements for forest products.

5. Forest influences. The effects of forest land and its vegetative cover on the water resource, for example. Effect of use of forests, forage, and wildlife, and of recreation, on each other, and on industry, agriculture, and local and national welfare.

Forest Service research concerning such things as prices, costs, and uses of forest products has been of direct value to manufacturers, dis-

tributors, and users of forest products. Research in fire protection and forest management, for example, helps solve problems that are vital to private and public forest-land owners generally. Results are made available to private, community, State, and Federal agencies alike. Facilities for research work that is sorely needed are no longer adequate. They should be extended.

Wages and hours.—Recent legislation with respect to wages and hours has created new and often perplexing situations for many private forest-land owners. and for many operators on both private and public forest lands. This situation will affect costs of production, employment, profits to owners and operators, and stumpage prices, for example. It is acute in regions like the South, where there are many small mills and where much small timber is being cut. This has a direct bearing on forest conservation. The Forest Service is now conducting an investigation of this situation. The object is to determine what the effects of recent wage-hour legislation are, and whether it will be possible to counteract increased costs with economies resulting from better operating methods and forest practices.

Taxation, tax delinquency, insurance.—There is widespread agreement that operation of existing State and county property-tax laws often leads to tax delinquency and neglect of cut-over lands, and that deferred-yield forest properties are often penalized because these taxes come every year while forest income may not.

There is no cure-all for these taxes. Taxing land is a function of State and local governments, but cooperative investigations, made by the Forest Service in an effort to encourage better forest practices, indicate that it is often possible to (1) reduce property taxes on forest properties through savings made by such improvements in organization and functioning of local government as will not curtail essential public services, (2) improve tax administration, and (3) apply adjustments to forest properties definitely managed for deferred yields.

In many counties there are owners who, after having defaulted for years in payment of current property taxes on cut-over forest lands, are permitted to redeem them at bargain prices. This penalizes owners who pay taxes regularly. Unless there is equitable taxation that will let private owners grow timber crops, and unless it is equitably applied, public ownership seems essential if something constructive is to be done with these lands.

Conservative estimates indicate that in Oregon and Washington the amount of forest lands forfeited for unpaid taxes rose from approximately 1,140,000 acres in 1933 to more than 1,850,000 acres in 1938, while forest lands tax-delinquent for 3 years and more rose

from about 3,560,000 acres in 1933 to more than 5,370,000 acres in 1938. Tax delinquency of cut-over forest lands rose in three Lakes States from 6,000,000 acres in 1929 to more than 20,000,000 acres in 1939.

This is a vicious circle. It adds to the taxes of property owners who pay, and helps force more forest liquidation. It also encourages the owner who pays taxes to seek compromises. Both are due in part to operation of State and county property-tax laws. Some cut-over lands have additional levies imposed to finance drainage of cropplands. These levies are usually prorated over all forest and other land within the drainage districts, whether that land is benefited or not.

Among remedies which seem applicable to this situation in the Yazoo delta of Mississippi are: (1) Legislative action to readjust drainage taxes in accordance with actual benefits to the properties concerned; (2) improvement of laws and practices in respect to assessment so that all land and timber may be taxed on an equitable basis; (3) abolition of special school and road districts as rapidly as their outstanding debts can be provided for, with establishment of the county as the basic unit of financing and administration; (4) increased State support of school and road functions. It may be possible to apply these remedies elsewhere.

Except in terms of human suffering, millions of acres of cut-over tax-delinquent forest lands have passed from private to public ownership without much cost. But public ownership alone does not alleviate the situation. Adequate contributions in lieu of taxes are necessary. Some States recognize this by making payments, usually at specified rates per acre, for forest lands they and their counties take over. Federal ownership carries comparable obligations. There is definite need for more uniform application of a simple and direct way to meet them. It should include allowances for differences in character and condition of forest land in different counties. A plan along these lines has been developed. As proposed, it applies to conservation lands under the jurisdiction of the Department of Agriculture.

If it can be applied to forests at reasonable costs and on a sound basis, fire insurance might provide relative freedom from financial losses that are often serious to forest-land owners. Studies by the Forest Service indicate that, with certain underwriting safeguards, forest-fire insurance should be practical in the Pacific Northwest and in the Northeast. Serious recent fires in the former region, and last fall's hurricane in the latter, will probably delay immediate action, however.

Solutions to Some Farm-Forest Problems

MOST farmers are confronted with the same problems that most industrial and nonfarm forest owners are. But there is a group of problems that because of certain conditions becomes of particular importance to owners of farm forests.

One of these conditions is that forest ownership is more widely distributed among farmers than it is among industrial owners, and that individual ownership is generally in smaller tracts. Pressure to cut farm forests for cash to buy such immediate necessities as food and clothing is also greater. This sacrifices values and throws unripe timber on the market more often. Methods and facilities used by most farmers for measuring, grading, pricing, and manufacturing forest products, and for selling them, are less effective than those commonly available to and used by larger industrial forest owners. It is also more difficult for the small owner than it is for the large one to get trained and experienced foresters, loggers, and millmen, and to locate and keep profitable markets.

Pooling of resources through associations is practiced among industrial and other large forest-land owners and operators. It offers what is perhaps one of the best ways to overcome many handicaps and problems that beset farm-forest owners.

FARM-FOREST COOPERATIVES

Last year the Farmers Federation, Asheville, N. C., marketed more than 1,000 carloads of pulpwood, about 15 carloads of locust fence posts, and 6 carloads of decoratives like rhododendron. Reports indicate that this federation has for years handled its members' farm-woodland products satisfactorily and successfully.

Cash incomes of farmers who participate in the Otsego Forest Products Cooperative Association at Cooperstown, N. Y., have been raised from $400 to $533 by that association's woods activities. The community has also benefited. Woods work made available to unemployed men reduced its relief costs from $279 in January 1938, to $40 in March 1938. This was a portion of the year in which there is normally an increase in relief expenditures.

This association was developed with the help of the Northeastern Forest Experiment Station, which wanted to determine basic methods and principles of organizing small forest-owner cooperatives. The cooperative now manages forest properties for some 300 mem-

bers. Most of them are farmers. Aided by a loan of $159,000 from the Farm Security Administration, this cooperative also manufactures forest products at its own plant, and markets them for its members.

Forest Products, Inc., of Groveton, N. H., has a loan of $100,000 from the Farm Security Administration. This cooperative sells but does not manufacture forest products. Nor does it manage farm forests. To encourage cropping the resource, a timber inventory has been completed within its territory by the Forest Service and the C. C. C. This inventory covers 288,000 acres. It includes more than 2,000 farm wood-lot owners. Data have been turned over to extension foresters for New Hampshire and Vermont. They are drawing up individual forest-management plans.

Comparable surveys of 21,000 acres in 38 tracts, and 30,000 acres in 900 tracts, have been completed in cooperation with the West Virginia Forest Products Association of Morgantown, W. Va., and the Tioga County Woodland Owners Association of Owego, N. Y., respectively. Extension foresters of these States are also making individual forest-management plans. State agencies are fostering cooperative management of farm woodlands, and marketing products from them, in the Yuba section of southwestern Wisconsin. Similar activities are of record in Clarke County, Miss., and elsewhere.

Farm-forest cooperatives may help their members through:

Farm-forest extension.—This in itself is a cooperative undertaking by the Forest Service, the Extension Service, the Soil Conservation Service, State agricultural colleges, and State forest and conservation departments. In 1938 it assisted farm-forest owners in 40 States and 1 Territory, employing 51 forestry specialists. But farm-forest ownership now seems important enough, and farm-forest problems acute enough, to justify the full time of trained foresters in each of some 600 counties.

Farm-forest extension also makes information about woodland protection and management available to cooperatives and owners. There are 21 million acres of farm forests that still need to be restocked; about 45 million acres that still need organized fire protection; around 75 million acres that must be rehabilitated if production on them is to be increased to reasonable levels.

Planting.—Last year 55,359,700 trees were produced and distributed at not more than cost to farmers, with the help of Clarke-McNary funds, in 41 States and 2 Territories. Additional planting of some 91,000,000 seedlings was made possible by the Soil Conservation Act; 9 million by the Tennessee Valley Authority Act. More than 46,500,000 trees and shrubs—of which 14,100,000 were for replacements over the entire project—were planted by the Prairie-States forestry

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project (p. 27), which was continued by the Forest Service as a work-relief measure.

The Cooperative Farm Forestry Act.—This act carries an annual authorization for not more than $2,500,000 for such things as: Raising and distributing trees, and planting them on farm woodlands; advising farmers with respect to protecting and managing farm forests and harvesting, utilizing, and marketing farm-forest products; investigations in farm-forestry problems and methods generally. Under this act Congress appropriated $300,000 for the fiscal year 1940. Overall administration is lodged with the Soil Conservation Service. Parts of the appropriation are, however, available to the Forest Service and the Extension Service.

Agricultural Adjustment Administration's conservation program.—Under this program, and with the advice of the Forest Service, the Agricultural Adjustment Administration has set up standards and provided benefit payments for (1) planting trees on forest lands withdrawn from cultivation, (2) excluding livestock from farm woodlands, (3) cultivating and maintaining trees in recently established plantations, (4) silvicultural work in young timber stands, including creation of desirable conditions in forests and woodlands damaged by the New England hurricane, and (5) a naval stores conservation program that last year affected approximately 85 percent of naval stores production.

New England Forest Emergency Organization.—This organization was set up by the Forest Service. Its headquarters are in Boston, with branch offices in each of 6 States. Within territory hit by the 1938 hurricane, which according to estimates affected 30,000 farm-forest properties, the New England Forest Emergency Organization is advising and assisting owners to reduce abnormally high forest-fire hazards (p. 19). Under contracts it also buys hurricane-damaged timber delivered by farmers and other forest-land owners to certain specified points (p. 20).

Public leasing of private land.—This device might be used for employing labor to improve and manage existing farm woodlands, and to establish, improve, and manage forests on submarginal lands. Experts estimate that there are 75,000,000 acres of submarginal land still being farmed, with 450,000 farm properties involved.

Under terms of a public leasing bill introduced in the last Congress, preference in employment would go to landowners and occupants. All work would be paid for by the Federal Government. Each owner would be allowed not to exceed 500 acres on which reimbursement, derived from use of the land and sale of its products, would be fixed at not to exceed 50 percent of the cost of the work. For work done on land in any one ownership in excess of 500 acres, reimbursement at the

rate of 100 percent would be required. This proposed legislation has aroused widespread interest.

The extent to which farm forests contribute to owners, and to which submarginal lands may contribute after forests are established on them, is indicated by research conducted by the Forest Service and certain State agencies. Average annual gross income from woodlands was found to be $122 per farm on certain Lakes States farms. Through better management and marketing it can be increased 50 percent. Other investigations in the Lakes States indicate an annual return of as little as $1 an acre from combined grazing and forestry use of farm woodlands, but close to $4 an acre—about the same as was yielded by the best open pastures—when woodlands were managed for forestry alone.

Records from Florida show net cash returns of $2.40 per day to farmers who "gum farm" their own second-growth pine woodlands during slack periods that aggregate 70 to 80 days a year. A county agent in Polk County, Tex., reports a total cash value of $478,332 for the 1938 timber crop there, compared with a total cash value of $379,080 for that county's 1938 cotton crop.

Research in Arkansas indicates that with the current average degree of understocking, an acre of loblolly pine there will, over a period of years, produce 4½ times as much cellulose per acre per year as the average acre of Arkansas cotton does. It also indicates that, if fully stocked and fully producing, the average acre of Arkansas loblolly pine will produce 11 times as much cellulose per acre per year as is produced on the average acre of Arkansas cotton. These figures do not mean that every acre of forest land in the country is capable of producing as much cellulose in as short a time as can be produced in the South. That is impossible, because growing conditions vary, as do opportunities for returns, between regions and between localities. But the figures do mean that people and communities near submarginal lands on which forests are restored and improved may look for more stable and higher returns from harvesting continuous forest crops.

Some Relationships

UNLIKE minerals, forests are living things. They grow according to nature's laws. They grow irrespective of property lines; on public as well as private land. Man can help nature reproduce forests, much as he can with cultivated crops. He can protect and improve them, and harvest them repeatedly.

As grass and browse, forage occurs on many mountain slopes above commercial forests. It also occupies much of the same land commercial forests do. Wherever this forage grows, it often helps support domestic stock owned by farmers, ranchers, and others. And horses, cattle, and sheep using pastures, as well as those using grass and browse on mountain ranges, must be controlled if both cultivated and wild forage are to be kept continuously productive and cropped.

Big game also commonly occupies much of the same land commercial and other forests do. This wildlife finds shelter and food there. And scenic charm and recreation—to which forests, forage, and wildlife contribute—are as much a part of public and private forest-land values as is the role these lands play in regulating and conserving soil moisture and saving farms from damage by floods and silt-laden streams.

Close relationships also exist between the Forest Service and the Agricultural Adjustment Administration, Soil Conservation Service, Farm Security Administration, Bureau of Entomology and Plant Quarantine, Federal Surplus Commodities Corporation, Bureau of Agricultural Economics, and Extension Service. Comparable relationships exist with the Bureaus of Agricultural Chemistry and Engineering, Animal Industry, Plant Industry, and with the offices of Land Use Coordination and Experiment Stations. These relationships help each bureau and agency redeem its specific responsibilities. They also help the Department with respect to its local, regional, and national responsibilities.

On mutual and interrelated problems the Forest Service also cooperates with and receives cooperation from State and county land-planning boards; agricultural colleges; farm cooperatives; State foresters; forest-fire protective, recreational, water users', and livestock owners' associations, and those of manufacturers of forest products; the Grazing and National Park Services and the Biological Survey of the Department of the Interior; the Disaster Loan Corporation; the Department of Labor; the Reconstruction Finance Corporation; the Civilian Conservation Corps of the Federal Security Agency; and the Public Works and Work Projects Administrations of the Federal Works Agency.

The Forest Service is and for more than 30 years has been regionalized and decentralized. Seven percent of its 5,500 regular employees are in the Chief's office, in Washington. They include members of the staff, which establishes policies and standards that apply to the whole Forest Service. The staff also checks on policies and standards, and on performance. Ninety-three percent of all permanent Forest Service employees are in the field. The National forests are grouped into 10 regions, with a regional forester in charge of each. The Forest Service also has 12 regional experiment stations.

Each of these, as is the Forest Products Laboratory at Madison, Wis., is in charge of a director. Regional foresters and directors act also as consulting members of the Chief's staff.

One purpose of this decentralized organization is to provide close and constant touch with local, State, and regional conditions. Another is to maintain such relationships there as will insure sympathetic and understanding consideration of current local problems.

Public Ownership and Management

OUTSIDE Alaska there are 462 million acres of commercial forest land in the continental United States. This, and the 168 million acres of noncommercial forest land, have many public values and perform many public services. One is to help prevent floods and erosion; another, to help protect the water resource.

Mississippi's Yazoo River Valley offers one of many examples of these two values and services. Forest land lost less than 0.5 of 1 percent of a 27-inch rainfall that occurred there in one 1931 storm, while cleared land lost 62 percent. In the same storm, cleared land lost 34 tons per acre of its topsoil, but protected forest land lost none.

Benefits like these are often worth more to the 130 millions of people than timber values are to the far smaller number who own most of the best forest land. These public services, and others that might be mentioned, indicate briefly why communities and States, as well as the Federal Government, should be adequately represented in public ownership and management of commercial and noncommercial forest land.

Community forests.—Cities, towns, villages, and counties get benefits from forest-land ownership and management. They receive direct returns from wood and other forest products. They also get intangible but very real public benefits from such things as outdoor recreation and pure and well-regulated water for domestic and other uses. Community forests also act as reservoirs for local employment.

Community ownership and management of forest lands has developed gradually but steadily. Communities now own and manage more than 1,500 forest areas, containing approximately 3 million acres. In many instances this ownership and management has been financially profitable. In many more instances it has been socially profitable. Community effort can help make such benefits available to many of the 20,000 counties and incorporated communities that are not forest-land owners and managers.

State forests.—States now own 19 million acres of forest land. Eleven million acres have been designated as State forests or parks. Ninety percent of this area is in New York, Pennsylvania, Minnesota,

Michigan, Montana, Idaho, Washington, New Mexico, Wisconsin, and Massachusetts. The South contains only 3 percent of existing State forests, but more than one-third of the country's commercial forest land. Much of the land in State forests in New York, Pennsylvania, and Massachusetts was bought from private owners. Much of that in other State forests was acquired through tax reversions or Federal grants.

State forests are protected from fire and trespass. The timber resource in many of them is under organized management. About 45 thousand acres are planted to trees annually. Recreation has been developed on nearly half of all State forests. Use, management, and protection of all of them have been greatly stimulated through emergency work done by the C. C. C. and the W. P. A.

Federal forests.—National forests were first created by reservations of public-domain lands, largely in the West. Nearly 11 percent of the publicly owned land in the national-forest system is now east of the Great Plains. Most of this has been purchased from private owners since 1933. Close to 52,000,000 acres of private land within national-forest boundaries often create difficult problems. They also increase costs of protecting, administering, and developing publicly owned resources.

There are now 175,843,405 acres of public land in national forests. This includes some 41,000,000 acres of grass, browse, and alpine country. In large part it is intermingled with more than 134,000,000 acres primarily in forest growth. All of this land is protected. The area burned annually fluctuates somewhat with climatic and other conditions, but the average for 1934–38 has been reduced 77 percent since the period 1910–14.

National forests are administered on a multiple-use basis. Slightly more than 46,000,000 national-forest acres are noncommercial forest land. A little less than 88,000,000 acres are commercial. Much of the latter is inaccessible, but last year 1,559,794,000 feet of timber was harvested, under regulation, from certain accessible portions of it. National-forest forage is used under permits by more than 6,500,000 head of domestic livestock plus their increase. And nearly 32¾ million people enjoyed wildlife and recreational opportunities and facilities on national forests last year.

National forests are reservoirs of work. They provided 13,436 man-years of it through the W. P. A. last year. They provided year-long work, and supervised training, for some 50,000 C. C. C. boys. Logging and processing national-forest timber furnished the estimated equivalent of 2,600,000 man-days of work. Owners employed close to 25,000 riders and herders to care for livestock grazed under permit. The number of people employed by summer resorts, dude ranches, and hotels catering to national-forest visitors is unknown,

but conservative estimates indicate that people spent more than $200,000,000 during their visits to national forests in 1937. Besides its permanent force of some 5,500 people, the Forest Service has more than 11,000 short-term employees during most years. In all, nearly 4,000,000 people who live in and near the national forests are supported in whole or in part through public ownership and management of them and their resources.

A program for increase in community, State, and Federal ownership of forest lands was discussed in last year's report. The extent to which public interests in private forest lands are protected by private owners should determine, in a broad way, how far public ownership and management of forest lands need go.

Stewardship

IN addition to protecting and administering national forests (p. 36), the Forest Service has responsibilities with respect to public welfare inherent in all forest lands no matter who owns them. Many of these responsibilities have been mentioned. Ways by which, with help from other (p. 15) organizations, bureaus, and agencies, the Forest Service redeems its stewardship, are indicated by the following.

NEW ENGLAND'S HURRICANE AND HER FORESTS

In September 1938 New England was hit by a terrific hurricane. It left the most dangerous and widespread forest-fire hazards the region has ever known. On large forest tracts and on some 30,000 farm wood lots, it also left an estimated total of 3 billion feet of down timber. This was tragedy. For generations New England's forests have been a raw-material source for industry and labor. Her wood lots have helped owners pay taxes and send children to school and college, and have provided a measure of security for old age.

After the hurricane, forest-fire-hazard reduction was essential for public safety. Timber salvage was vital to economic welfare. New England appealed in this double emergency to the Federal Government. The President instructed Federal executive departments and agencies to give every possible assistance. He designated the Chief of the Forest Service, who had been authorized to call on all resources of the Department of Agriculture, to coordinate the work.

The Forest Service immediately set up the New England Forest Emergency Organization, with headquarters in Boston. It was staffed by experienced forest officers. Except on national forests, where the work is done by forces that protect and administer them,

the Emergency Organization's job was, and is, to handle hazard reduction and timber salvage in New England.

Town committees and State authorities, including State foresters who acted for Governors, helped draw up hazard-reduction plans. Decentralized organizations were established by the Organization in 6 States. Cooperation was offered by the Works Progress Administration and the Civilian Conservation Corps. Within a week after the central office was established, W. P. A. and C. C. C. forces were at work. They reached a peak of 25,000 men in November. By June 30, 1939, 338 miles of telephone lines for fire protection had been erected, fire hazards had been reduced to normal on some 45,537 acres adjoining heavily used roads, and 6,077 miles of roads and trails had been cleared. So had 29,844 high-hazard acres around towns and buildings. In cooperation with the Weather Bureau, 44 emergency forecasting stations had also been established, and daily fire-weather warnings were being issued and broadcast.

Meanwhile Congress included in the first urgent deficiency bill an appropriation of $500,000 to continue forest-fire-hazard reduction on the White Mountain National Forest in New Hampshire and Maine, and one of $5,000,000 for forest-fire-hazard reduction work outside the national forests in New England. The latter appropriation was subject to a proviso that money used in any State must be matched dollar for dollar by the State or political subdivision.

These funds became available on April 1. The 5 million dollars made purchases of badly needed equipment and supplies possible. It also permitted establishing twenty-one 50-man camps and putting 2,500 men in mobile crews. They supplement and complement W. P. A. and C. C. C. forces. But the 1938 hurricane damaged 4,600,000 acres of forest land. On 600,000 acres of it fire hazards threatened homes, towns, and human lives. The New England Forest Emergency Organization reported 14,190 laborers working on hazard reduction outside national forests during June 1939. Of these, 3,418 were from the C. C. C. and 7,709 were from the W. P. A. It reported that more than 2,500,000 man-days of hazard-reduction work had been done to June 30. But it also estimated that at least 2 more years of intensive work will probably be necessary before emergency forest-fire hazards can be reduced to normal in New England.

Timber salvage, coordinated with hazard-reduction work, is cleared through the Northeastern Timber Salvage Administration. The Chief of the Forest Service is its administrator. With offices and facilities in each of six States, this administration was set up within the framework of the Federal Surplus Commodities Corporation.

Federal funds are made available as loans from the Reconstruction Finance Corporation through its subsidiary, the Disaster Loan Cor-

poration. These loans are based on market values of such salvaged hurricane-damaged forest products as, delivered by owners or their agents to designated points, are measured and accepted there by trained Northeastern Timber Salvage Administration employees. This Administration does no logging. It does pay owners after they or their agents deliver salvaged material. Immediate payments are on a basis of 90 percent of the fair market value of material that then becomes the property of the Administration and security for its loans. The Administration also agrees to prorate among participating owners such balances as may remain after completion of the entire salvage job, and after all expenses, including return of the loans with interest at 3 percent, have been paid. Grade specifications for acceptable sawlogs, tie logs, and pulpwood are standardized. So are prices paid for designated species, grades, and classes of material.

Estimates indicated that 1,643 million feet of the hurricane-felled timber was merchantable; that slightly more than 1,400 million feet of it might be salvaged if it could be stored in ponds or manufactured before serious deterioration set in; that private enterprises might salvage about 544 million feet, but that the Salvage Administration would probably have to function with respect to 873 million feet or more. On November 21, 1938, 60 days after the hurricane, the first logs were delivered. By June 30, 1939, and with the aid of town committees and cooperating town, State, and Federal authorities, 254 wet and 525 dry delivery sites had been established, and 11,451 purchase agreements had been signed. The latter represented 1,520,906,000 board feet in logs, plus 91,483 cords of pulpwood. Deliveries to June 30 totaled 474,985,000 board feet in logs and 7,013 cords of pulpwood. Payments to owners, covering most of these deliveries, totaled $5,165,332. Contracts had also been signed with 274 privately owned sawmills, of which 238 were in operation; and 129,965,000 feet of lumber had been sawed, stacked for drying in storage yards, and invoiced.

During the summer it became necessary to confine delivery of logs to wet-storage sites and to those dry-storage sites where immediate sawing was possible. This was because of increases in stain and insect damage. In the meantime market conditions had been studied, as had possibilities for new outlets. The plan is to offer logs in ponds, where they can be held for long periods because deterioration is slight, for sale to local established industries. This should prolong operations, provide work for local people, and postpone the need for cutting undamaged forests. Lumber sawed largely because enough wet-storage sites were not readily available will be so disposed of as to prevent disorganization of local and other lumber markets as far as possible.

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Timber salvage in New England is recovering an appreciable part of the wrecked forest resource there. Fire-hazard reduction is helping protect human lives and the remaining forest resource. Although perhaps 95 percent of timber losses were in white-pine stands, the white-pine seed crop was excellent during the 1938–39 season. This was fortunate. It means that, with adequate protection, white pine may confidently be expected to reclothe many damaged areas. Among measures that should help restore New England forests—nearly 75 percent of its area is forest land—and provide continuous yields of white pine and other species with grades definitely superior to those of the pine damaged by the hurricane are:

1. Wider knowledge among woodland and other forest owners of better facilities and methods for protecting and managing their forest properties generally, and for grading, manufacturing, and marketing forest products.
2. A better system of administrative districts to coordinate forest efforts and to afford technical assistance to forest agencies and owners.
3. Acquisition by local communities and the States of some of the more heavily denuded forest areas, and development and management of them as demonstration forests and as reserves for local employment.
4. Public leasing of private forest lands as an aid to unemployment, to reforest them, and to manage them for owners (p. 14).
5. Public regulation (p. 2) to prevent exploitation of the forest resource.

RESEARCH

Research is a major responsibility of the Forest Service. Its general scope has been defined briefly on page 9. Relations to problems like uses and markets for forest products, wages and hours, taxation and tax delinquency, and farm-forest cooperatives have been indicated. Diversity of its projects, and stewardship with respect to certain of them, are indicated by:

The forest survey.—This stock-taking project is providing authentic information basic to forest land-use planning and management of regional and country-wide forest resources for continuous production. It is gradually showing what is necessary to insure ample permanent timber supplies. The work is done on private as well as public forest lands. Results are available to individuals, industries, communities, and public and private agencies generally.

Field work covered less than 10,000,000 acres this fiscal year. The total area covered to date is 287,000,000 acres. That not yet covered is about 343,000,000 acres. The timber-supply phase so far completed includes 24 progress and final reports on 100 million acres, and forest-type maps for all or parts of 8 States. For the probable

forest-products requirements phase, investigations have been made and reports issued for nonfarm housing, furniture, mine timbers, and hardwood distillation.

Sweden and Finland, recognizing the tremendous importance of a reliable nation-wide forest inventory, are working on their second one. Field work is not yet 50 percent completed on our first one, and with inadequate regular appropriations, and emergency funds no longer available, field coverage is now nearly at a standstill. Progress in analysis and interpretation is too slow. It is increasingly difficult to keep up with requests for information from public and private agencies.

Forest management and economics.—Studies continue to furnish information as to the practicability of more conservative partial-cutting methods in the southern pine, ponderosa pine, and under some conditions in the Douglas fir regions. These studies have stimulated a definite development of improved methods of forest management. This will help stabilize local industries. Cutting which removes two-thirds of all merchantable trees in Lakes States northern hardwood stands brings an annual increment of 150 to 200 board feet per acre over a period of years. Light selection cuttings that remove only about one-third of the merchantable volume of the stand bring 240 board feet per acre. Average annual income from farm woodlands can be increased from one-third to one-half through better cutting practices and marketing, according to preliminary studies in Wisconsin and New York.

Studies in Arizona indicate that lighter cutting than has been practiced on most private forest lands is economically feasible and silviculturally advantageous there. Investigations in southern forests show that selective management of second-growth shortleaf and loblolly pine is profitable. General adoption of it should help satisfy southern requirements for pulpwood and saw timber, help keep forests productive, and help stabilize industries and communities dependent on them.

Accurate growth prediction is essential to sustained-yield management of forests since it provides the basis for determining the volume and kind of material that can be cut over any period of time without depleting the growing stock. At the same time it is one of the most perplexing problems facing forest managers, for growth varies widely with the class of timber, density of the stands, and the extent and nature of the mortality. In the Lakes States a growth formula has been developed that makes possible a more accurate prediction of increment for 20 years in advance. It is anticipated that through the application of this formula, cuts can be so regulated as to permit continuous operation of forest properties and greatly increased future growth.

Improved methods of gaging watering needs have saved $300 per month in one large nursery, and refinements in specifications for nursery stock have increased survival of field-planted trees by as much as 50 percent in the Lakes States. The rate of spread of fires in southern coastal plain forests has been determined. This aids fire suppression there. Stumpage prices paid from early times up to and including 1934 for privately owned timber have been compiled, analyzed, and published. So have stumpage and log prices for 1937. Experiments to propagate and develop tree strains with better qualities continue at experimental stations in California and the Northeast. More than 50 promising poplar hybrids are being tested out in many regions. Promising hybrids have been obtained with maple, birch, oak, basswood, and yellow poplar.

Forest products, uses, markets.—The prefabricated plywood-panel system for building houses has been proved technically sound and practical for one- and two-story structures with flat and sloping roofs. Arches, beams, rafters, and other large-dimension members made by gluing together small boards were first developed and demonstrated experimentally in the United States in 1935. This method is now used commercially in such structures as barns, auditoriums, and ornamental churches.

Substitution of chemical for mechanical seasoning of heavy timbers has proved practical in initial tests under commercial conditions, and wood is again on an equivalent technical basis with other materials for use as walking beams for oil derricks, for example. Next to cellulose, lignin is the largest chemical constituent of wood. Certain methods to convert it into new and useful products have been developed, and in the initial stages they are being applied commercially. By incorporating lignin with the negative plate, it has been found that storage batteries maintain maximum power in zero weather four times as long as they formerly could. To help consumers select the right species and qualities for their specific requirements, and to help overcome certain marketing difficulties, studies are being made of the working qualities of hardwoods in the southern, New England, and Appalachian regions. The tire-tube method of treating fence posts against decay—zinc chloride put in a discarded inner tube and attached to the butt end of the freshly cut post—has proved simple and inexpensive in actual use. Application of the semichemical process to blackjack oak and red gum resulted in high-yield pulps which were readily converted to high-quality corrugated stock.

Range management.—Many national-forest ranges furnish lush summer forage. Seasonal development of forage plants on these mountain ranges varies as much as 20 to 100 days from one year to another. When snow disappears early, range plants develop early,

and vice versa. But the length of the period of development ordinarily remains constant. This relationship makes it possible to predict with reasonable accuracy the date when ranges will be ready for grazing each year. Best results are obtained when, if a uniform opening date for the grazing season is established, that date is set 5 to 10 days later than the average date of range readiness over a series of years.

Too close and too frequent grazing of perennial forage plants on mountain ranges literally starves the plants, but reasonable grazing is not detrimental to them. Experiments conducted at the Intermountain station indicate the need for relatively light grazing (1) during the intense reproductive period when foods are used in the growth processes as rapidly as manufactured, and (2) after seed maturity when food storage is taking place. They also indicate that grazing should not be too close or too frequent during the spring and summer when the plant is manufacturing its food for current growth.

Below national forests are foothills and valleys which furnish spring and fall forage for livestock. Research at the United States Sheep Experiment Station in Idaho, in cooperation with the Bureau of Animal Industry, shows that body weights of sheep fluctuate directly with the amount of forage available on spring and fall range; that short forage supply during these periods means poorer condition of the herd and fewer lambs.

Indications are that sagebrush-bunch grass range in the Snake River plains of Idaho can provide its maximum share of forage when grazed in the spring and the fall under a rotation system. Different parts of the range should be grazed first in different years, starting when grasses are 2 inches high. Only a third of the available bunchgrass growth on the range should be grazed in the spring. Another one-third should be grazed in the fall, after the sheep return from summer grazing on higher ranges. The remaining one-third of the grass growth should be left ungrazed to assure sustained vigorous production by the plants the following spring. Such range use furnishes green forage during the spring lambing period, and adequate forage during the fall breeding season. It also reduces costly supplemental feeding during these periods in drought years.

Seeding of slender wheatgrass, mountain brome, and smooth brome have increased the forage value from 6 to 10 times on depleted mountain slopes in central Utah where rainfall averages from 12 to 20 inches annually. In cooperation with other Federal and State agencies and local stockmen, the Western Range Survey completed plans to maintain range productivity and better range and livestock management for 107 counties, involving 55 million acres of range land. Regional committees representing all interests help focus attention on, and solve, current range problems.

The water resource.—Usable water is a necessity, but the quantity available fluctuates continually and inherently. Recognizing that the condition of watershed lands markedly affects yields of usable water, areas are being purchased by public and private agencies to protect supplies. Actual prices recently paid have ranged from $16.50 to $450 per acre. Results of forest-influences investigations have confirmed earlier observations on the effectiveness of vegetative cover in controlling soil erosion, increasing infiltration into subsurface supplies, and increasing the usability of surface flows. Under dense chaparral, only a negligible amount of overland flow occurred during the record California storm of March 1938. Later in the year, after the area had been burned, heavy surface washing occurred during a storm of normal intensity.

Most efforts to conserve and control the water resource have centered on lower reaches of streams and rivers in the past. Under the Flood Control Act of 1936, the War Department remains the national agency for downstream engineering. But the act recognizes the Department of Agriculture as the Federal agency to investigate and take measures for retarding and controlling run-off, water flow, and soil erosion on watersheds.

Flood-control surveys.—Funds made available in the War Department Civil Appropriations Act, 1939, permitted expansion of the Department of Agriculture flood-control surveys authorized by the Flood Control Act of 1936. These surveys are carried on jointly by the Forest Service, Soil Conservation Service, and Bureau of Agricultural Economics. Eighty-nine preliminary examinations were completed and detailed surveys of 18 watersheds were conducted during the year. Many of the surveys were nearing completion June 30.

These surveys involve analyses of relations of present watershed conditions to floods and siltation, including detailed study of the amount, type, and distribution of flood and silt damages, their origins, and means of reduction or prevention. They require knowledge of geology, soils, methods of farming, condition of forest and range land, historical and social development, economy of specific areas, precipitation and run-off, and dependencies of populations. Programs and plans for corrective measures must take account of economic feasibility as determined by costs and benefits, and as limited by social and economic values at stake.

Such changes in land use and management as may be desirable or necessary to reduce damaging siltation and flood flows are related, in the program, to people of the uplands as well as the lowlands. Previous experience by the Forest Service in long-range resource and land use planning has helped in the work of these surveys. The surveys, in turn, have shown the need for certain modifications of acquisition programs and national-forest-management methods.

Officials of the Forest Service served as chairmen of the tribureau committees on 6 of the 18 surveys where forest problems have major importance. On the remaining 12, where the problems arise chiefly from agricultural use, the Soil Conservation Service has supplied the chairmen. These watershed surveys constitute trials of methods and procedures in a specific field that is new to the Forest Service and the Department. Experiences gained from them, which have blazed the trail in interbureau cooperation for land-use adjustments, will be invaluable in prosecuting flood-control and other action programs on nearly 400 additional watersheds already authorized for survey.

FOREST INDUSTRIES CONFERENCE

Primary purposes of the Forest Industries Conference, established in 1939 at the suggestion of the Forest Service, are (1) to maintain appropriate and effective relationships between forest industries and public agencies having to do with the forest resource, (2) to assure cooperative consideration of business problems common to forest industries and the forest resource, (3) to insure coordinated handling of such problems by the different agencies directly concerned.

This conference is a catalytic rather than a policy-making organization. For forest industries it has been approved by the National Lumber Manufacturers Association, the American Pulp and Paper Association, and the American Pulpwood Producers Association. Among Federal agencies approval has been registered by the Departments of Commerce, Agriculture, and Interior. Membership in the conference, which hopes to assist in solving forest-industry problems on a cooperative basis and help promote better practices on forest lands, consists of one representative from each of these associations and Departments.

PRAIRIE-STATES FORESTRY PROJECT

Through the use of emergency funds the Forest Service has continued this project, conceived by the President in 1934, within an area in which there are 200,000 farm families. In less than 5 years, and with an expenditure of Federal funds that has averaged less than $1,665,000 each year, this project has planted about 11,000 miles of living barriers against scorching winds. Nearly 4,100 miles were planted this year. Farmers have made land available. Through material and labor for fencing, by land preparation, plowing, and cultivating, which extends over 3 to 5 years, and protecting trees from rodent damage, they bear at least 50 percent of the total cost of the project.

These tree barriers are about 100 feet wide. Many trees in them have grown from 4 to 8 feet each year, and some have reached 35 feet in height. Since being planted these living barriers have reduced soil-moisture losses at critical times, checked wind erosion, protected cultivated crops, and made localities more attractive and better places in which to live. Now, well established, they also provide the basis—through carefully conducted thinning operations—for harvests of fence posts, rural telephone poles, and wood for fuel.

THE CIVILIAN CONSERVATION CORPS

The Civilian Conservation Corps was organized early in 1933. Its first camp, on the George Washington National Forest in Virginia, was occupied on April 5, 1933.

The number of C. C. C. camps in the States has varied. The average from April 1, 1933, to June 30, 1939, has been 1,803. The average number of enrollees in these camps has been 314,054. The average number of camps and of enrollees under general supervision of the Forest Service has been 954 and 164,991, respectively. Including enrollees in Alaska and Puerto Rico, where the camp system is not comparable to that in the States, general supervision by the Forest Service has extended to an average of 167,000 C. C. C. enrollees per year. The total for 6½ years, including reenrollments, probably exceeds 2,150,000.

Forest Service supervision has entailed a fourfold responsibility: (1) Planning constructive, worth-while projects and supervising the work on them; (2) helping rebuild the boys and men physically, mentally, and spiritually; (3) helping train them so they may get and hold worth-while jobs in private employ; and (4) guarding their safety.

One of the qualities required of C. C. C. supervisory personnel is that its members shall have ability to train enrollees. Ninety-four percent of this personnel in camps for which the Forest Service is responsible give on-the-job training to C. C. C. enrollees, and 88 percent give of their own time to off-the-job training. This has helped enrollees find jobs and hold them, according to Robert Fechner, Director of the Civilian Conservation Corps, who reports that more than 515,000 enrollees left camps prior to completion of their enrollment to accept private jobs between April 1933 and July 31, 1939.

Since January 1936, there has been a planned safety program in all C. C. C. camps. Its effect in Forest Service camps is indicated by the rate of lost-time accidents and fatalities per 1,000 enrollees. This rate dropped from 10.0 in January 1936 to 3.03 in May 1939.

Fighting forest fires is a dangerous as well as a difficult job. One of the most important parts of the safety program is training for it. Advance training is given to every enrollee who might conceivably be called on to take part in fire fighting.

Long-range plans for protecting, developing, and using resources like timber, forage, and water, and such forest-land values as recreation, are essential parts of administering national forests. These plans—extended, brought up to date periodically, coordinated, and adapted to enrollees and administrative requirements of their organization—have formed bases for C. C. C. work projects on national forests. Similar plans have been developed for all camps working on State forests, on Tennessee Valley Authority projects, and on private forest land. The Forest Service is also responsible for the work of these camps.

On private forest land C. C. C. projects have been confined, for the most part, to those essential to protection against fire, and against insects and diseases (p. 4). These projects include building and maintaining roads and trails, bridges, telephone lines, lookout houses and towers, supply and storage buildings, and firebreaks. Fire-hazard reduction along roads and trails is also a private-land project, as is work in preventing fires and in fighting them.

On publicly owned forest land a wider field is covered. The following national-forest projects are indicative of it. Figures used cover approximately 6½ years.

Planting.—C. C. C. enrollees have planted 823,102,000 young trees on 914,560 acres of national-forest land that have been burned, or that were too heavily cut by private owners before they became public property. Current estimates indicate that there are 3,600,000 acres still in need of planting.

Fire protection.—Fire protection is perhaps the most important contribution made by the C. C. C. On national forests it includes construction of more than 42,777 miles of roads and trails, 1,800 lookout structures, and 26,942 miles of telephone line, in addition to maintenance on these and other projects. It also includes 2,588,330 man-days on presuppression and fire-prevention work, and 2,037,000 man-days on fire fighting. These, with maintenance and a certain amount of new construction, are ever-recurring jobs.

Wildlife restoration.—Enrollees have improved and developed wildlife refuges; worked on game censuses; planted wildlife food; captured big game and transported it to understocked areas; built fish hatcheries and rearing pools, and stocked thousands of streams and lakes with millions of young fish.

Range management.—National forests furnish summer feed for domestic livestock (p. 42). Heavy concentrations of ground squirrels,

prairie dogs, pocket gophers, porcupines, and rabbits damage this range resource, on which big game also depends. Under the immediate direction of the Bureau of Biological Survey, C. C. C. enrollees have helped control rodents on some 6,896,480 acres in national forests. They have covered 90,380 national-forest acres in efforts to eliminate plants and shrubs that are poisonous to domestic livestock. And they have developed springs and water holes, constructed corrals, and built and maintained pasture and drift fences. These activities help secure better range management.

A complete list of accomplishments by enrollees is included in annual reports of the Director of the Civilian Conservation Corps, now a part of the Federal Security Agency.

THE HONOR ROLL

On March 22, 1939, the first three awards for heroism in fighting fires were made by the American Forest Fire Foundation. District Ranger Urban J. Post, of the Big Horn National Forest, was present to receive his medal. One was awarded posthumously to Junior Forester Paul E. Tyrrell, of Oakland, Calif. Presentation of the award to Bert Sullivan, a fire-control cooperator of Cody, Wyo., was announced, and was made later in a ceremony at Cody. These awards were for heroism in fighting the Blackwater fire on the Shoshone National Forest in August 1937. Deaths from that fire were recorded in the 1938 annual report.

The 1939 honor roll includes 13 men. Despite the training referred to on page 28, 10 of the men who died were members of the C. C. C.

Seven enrollees and one foreman from camp S–132 lost their lives on the Pepper Run fire near Emporium, Pa. This fire occurred on October 19, 1938, and Squad Foreman G. Mahoney and Enrollees B. Bogush, A. Stephanic, J. F. Boring, H. F. May, S. Jocofsky, G. Vogel, and R. Hollabaugh were trapped by a sudden shift of wind. The five first mentioned died immediately. The last three died later of injuries received at the fire.

John B. Jones, enrollee of C. C. C. Company 1998, and John Thompson, enrollee of Company 2930, lost their lives on the Swamp Creek fire, Cabinet National Forest, Mont., and the Le Clerc fire, Kaniksu National Forest, Mont., respectively. Thomas E. Grubb, an Emergency Relief Administration tank-truck driver, was killed in a collision between his truck and a private automobile in southern California. Ernest L. Emory and Clyde T. Hamilton died of bronchial pneumonia after fighting the Cedar Camp fire on the Siskiyou National Forest in Oregon.

REPORT TO THE JOINT COMMITTEE ON FORESTRY

In the President's message [1] of March 14, 1938, to Congress, he recommended appointment of a committee to study the forest situation. "I hope," he said, "these studies * * * will form the basis for essential legislation during the next session of Congress * * *." He suggested that "particular consideration might * * * be given * * * to the situation with respect to private forest lands, * * *." And he stated that—

> Facilities of those technical agencies that, in the executive branches of the Government, deal with the many phases of our forest problem will, of course, be available to such committee as the Congress may appoint. These technical agencies will be glad to assist the committee in assembling and interpreting facts, indicating what has been done, what still needs to be done, and in such other ways as the committee may desire.

Congress appointed what is known as the Joint Committee on Forestry.[2] Time originally set for it to investigate and report has been extended [3] to April 1, 1940. The committee has held public hearings, and plans to hold more. In an effort to be helpful the Forest Service has prepared a report in preliminary form. A large group of Forest Service field and office personnel helped collect and interpret the data in it. Suggestions with respect to legislation, appropriations, and action programs have been included. Advance copies have been sent to many outstanding individuals and to representatives of such typical associations and groups as: American Farm Bureau Federation, American Federation of Labor, American Forestry Association, American Turpentine Farmers Association, Association of State Foresters, Babson Institute, Carnegie Institution, Congress of Industrial Organizations, Farmers Union, Izaac Walton League, National Grange, National Lumber Manufacturers Association, Society of American Foresters, National Wildlife Federation, and the United States Pulp Producers Association.

Individuals, groups, and associations have been asked to criticize and comment on the report as prepared. Conferences have been held, and others are planned. These conferences, criticisms, and suggestions will be helpful in putting the report in final shape for transmittal to the Joint Committee on Forestry.

RECREATION

Timber and minerals, grass and forage, game and water are tangible forest crops. Definite values can be put on them. Certain values of

[1] Doc. No. 539, 75th Cong., 3d sess.
[2] S. Con. Res. No. 31, 76th Cong., 1st sess.
[3] H. Con. Res. No. 11, 76th Cong., 1st sess.

recreation defy price analyses. But they are real values just the same, for they help change for the better the spirit of a country's people.

Forest recreation has become a downright necessity for great numbers who may not be able to buy a change of air by sending the family to a resort for the hot season. Recognizing this public need, the Forest Service has summarized experiences of many of the 32¾ million Americans who discovered the national forests as a natural retreat and playground last year. Summarizing also its own experiences in coordinating recreational and other uses of national-forest resources, a publication about outdoor recreation with particular reference to national forests is being prepared.

Written in popular style for the layman, this publication outlines opportunities and demands for outdoor rest and change on national forests in Alaska, Puerto Rico, and in 36 States. It shows how recreation is coordinated and interrelated with other national-forest uses. It indicates some of the effects of mass outings on local economy. It suggests ways and means of providing a more equitable distribution of forest outings to the underprivileged and low-income groups. And it has helped the Forest Service restate old and establish new policies and procedure with respect to management of recreation on the national forests.

INTERDEPARTMENTAL COMMITTEE

During the year a committee representing the Departments of Interior and Agriculture has been established. It consists of two members from each Department—one representing the Secretary of the Interior, one the Secretary of Agiculture—and one member each from the National Park Service and the Forest Service. Its purpose is to facilitate consideration of policy and administrative matters of mutual interest.

Through this interdepartmental committee agreement was reached during the year with respect to reports made to the Congress and the Bureau of the Budget on more than 30 separate legislative proposals. Agreement was also reached on proposals to transfer certain national-forest areas to (1) the Rocky Mountain National Park in Colorado, and (2) the Glacier Bay National Monument in Alaska.

NORTHERN PACIFIC LAND-GRANT SUIT

The Northern Pacific land-grant suit involves the claim of the Northern Pacific Railway Co. for damages because it was denied the right to select 2,800,000 acres of land within its indemnity limits in Wyoming, Montana, Idaho, and Washington.

The Federal court for the Eastern District of Washington has now rendered its decision with respect to points of law involved. Certain

of these points were decided in favor of the company, and certain of them were decided against it. An appeal directly to the Supreme Court of the United States, as authorized by special statute, was deferred pending decision in a separate suit instituted by certain minority stockholders in the railroad, but was perfected before the close of the year. Expectations are that it will be argued before the fall term of the Supreme Court. Meanwhile, the Forest Service cooperated actively with attorneys of the Department of Justice in assembling data necessary for presentation of the Government's case.

LAND-USE PLANNING

Problems of land use and economy have multiplied in number and increased in vital social significance. Comparable increases have occurred in the number of public, semipublic, and nonpublic agencies set up to study such problems, and to plan and execute measures to solve them. A member of the Chief's staff has been designated to assume primary leadership of land-planning activities within the Forest Service, and to correlate efforts in land planning with those of other bureaus of the Department and other Federal, State, and local agencies. This staff member will be assisted by the Division of Forest Land Planning, which hitherto has been designated as the Division of National Forest Planning and Establishment.

The National Forests

THE Forest Service has had jurisdiction over the national forests since February 1, 1905.

On June 30, 1939, there were 2 national forests in Alaska, 1 in Puerto Rico, and 155 in 36 States. There were also national forest purchase units in 4 other States. The total area within exterior boundaries of national forests and purchase units is 227,560,937 acres. Of this, 175,843,405 acres were owned or in course of acquisition by the United States, while 51,717,532 acres were in State or private ownership. Of the Federal lands, 17,023,200 acres have been purchased under the Weeks Law. The remainder was reserved from the public domain or acquired through exchange, donation, or transfer.

Tables giving gross and net areas of each national forest, by States, and other information, are included in section Z of volume X, Administrative Statistics. This section (p. 48), or any of the individual tables in it, will be mailed on request.

ADDITIONS AND ELIMINATIONS

The national-forest system is not static. Forest land in private ownership is acquired in the public interest for additions through exchange, purchase, and donation. Suitable public domain and other Federal land is added and eliminated through transfers and boundary adjustments.

Additions by exchange.—The procedure of additions by exchange is applied to private forest land within national forests. In some instances it is also applied outside but adjacent to them. Its object is to simplify national-forest administration and reduce costs of protection.

There were 103 exchanges completed during the year. They conveyed to the United States 209,143 acres, valued at $670,007. The Federal Government gave, in lieu, 104,480 acres valued at $360,295 and 96,128,000 board feet of stumpage valued at $271,391. Net gain in national-forest area by these transactions was 104,663 acres. Besides these exchange transactions, 145 others were approved by the Secretary of Agriculture, and referred by him to the Secretary of the Interior or to the National Forest Reservation Commission. They had not been completed by the end of the fiscal year.

One important exchange completed was in the Delta purchase unit, Mississippi. Here 40,857 acres containing 77,020,000 board feet of commercial timber were offered the Government in exchange for $404,111 worth of national-forest stumpage. In another exchange, on the Modoc and Shasta National Forests, Calif., the Government was offered 71,017 acres supporting 340,065,000 feet of timber for an equal volume of national-forest stumpage.

Additions by purchase.—No emergency funds were allotted for purchase of forest land for national forests during the fiscal year 1939, and the regular appropriation bill carried only $3,000,000 for this purpose. At three meetings the National Forest Reservation Commission approved for purchase 521,939 acres for a total of $2,158,405, and obligated the balance of the appropriation. Purchases with Uinta-Wasatch receipts, in Utah, were 16,381 acres for a total cost of $47,541. Included in approved purchases were (1) 11,265 acres tributary to Bend, Oreg., to help put forests on which four-fifths of its people depend on a continuous-yield basis; (2) 6,251 acres in the coast redwood belt, California, including some virgin timber; (3) 13,394 acres that, in the Jefferson National Forest, in Virginia and Kentucky, include the famous Breaks of Sandy.

Area vested in Federal ownership through final payment during the year aggregated 697,179 acres. The aggregate area acquired by

purchase to June 30, 1939, is 16,369,751 acres. Of this 11,837,053 acres have been acquired since June 1933.

Additions through donations.—During the year 40 tracts embracing 39,881 acres were donated and accepted by the Secretary. The total donated to June 30, 1939, including administrative sites, is 337,388 acres.

Additions by transfer.—To facilitate economy in administration the President approved transfer of 262,379 acres, formerly managed by the Resettlement Administration and its successors, to national-forest status during the fiscal year 1938. During the same year the Secretary of Agriculture assigned 314,980 acres to the Forest Service for protection and management. This year the President approved transfer of 122,972 acres, including the Magazine Mountain project to the Ouachita National Forest, and the northeast Georgia project to the Chattahoochee National Forest. The Secretary also assigned 35,124 additional acres to the Forest Service for protection and management, pending action to give these lands national-forest status.

Additions and eliminations by boundary adjustments.—Progress of purchase and exchange programs requires constant shaping and reshaping of national-forest boundaries to provide effective and economical administration. This, in brief, was the basic reason for 49 bills covering 36 specific boundary adjustments introduced in Congress last fiscal year.

Proclamations or Executive orders formalized the following changes during the year: The Manistee National Forest was established, in Michigan, from lands previously acquired by purchase. The Lemhi National Forest, Idaho, was abolished, but the lands were transferred to the Challis and Salmon National Forests in Idaho. Under authority granted the President by Congress, 411,813 acres, of which 33,586 acres were public domain, were added to the Deschutes National Forest, Oreg. The President also added 392,686 acres, including 6,710 acres of public domain, to the Cache National Forest in Utah. He transferred 505,600 acres from the Tongass National Forest to the Glacier Bay National Monument, Alaska.

The National Forest Reservation Commission approved many adjustments and changes in purchase units without either adding to or subtracting from national-forest acreage. Additions to national forests by boundary adjustments grossed 957,067 acres during the year. There was one elimination—the 505,600 acres mentioned above.

Protecting the National Forests

FORESTS in State and private ownership must be protected from fires and from insects and diseases (p. 4). So must the national forests; for fire, insects, and diseases damage and destroy their resources on which people depend for their livelihoods, and accelerate erosion and floods. Scarring and marring the landscape, fires, pests, and diseases also destroy beauty; make it impossible for people to find peace or inspiration in forests or to enjoy recreation there.

PROTECTION FROM FIRE

The need for protecting national forests from fire is indicated by the fact that during the calendar year 1938 one series of 3-day electrical storms in northern California and southern Oregon, unaccompanied by rain, set 60 and 150 fires on the Siskiyou and Klamath National Forests, respectively. The need is emphasized by the fact that although skilled leaders were promptly assembled from two States, and advanced forms of organization and technique were used, including prompt delivery to fire camps by aircraft and parachutes of 112 tons of supplies and equipment, the Cedar Camp lightning fire on the Siskiyou National Forest burned 34,000 acres and had to be fought for 26 consecutive days in rough and rugged terrain before it was brought under control.

This was the largest national-forest fire in 1938, but it was only 1 of 5,702 that were set by lightning and 7,838 that were man-caused. All but 73 of these fires were held to less than 300 acres in size, but the 13,540 fires burned 219,000 acres. Of this area, 175,000 acres are in Federal ownership. Damage to tangible Federal values by these fires was estimated at $476,354. Including the appraised value of work done by C. C. C. and E. R. A. units, expenditures for fire fighting were $2,587,041.

Fire prevention and cooperation.—In 1938 the American Association for the Advancement of Science organized an advisory council on human relations. It is cooperating on fire-prevention problems, particularly those having to do with man-caused fires. Detailed psychosocial studies were carried out by the Forest Service in the search for more effective ways of reaching the attitudes and habit patterns of people who start fires intentionally or carelessly. Planned educational campaigns in cooperation with newspapers, radio-broadcasting systems, motion-picture theaters, and civic and other organizations, were continued and intensified.

Fire suppression.—On national forests in 1938 there were 232 more lightning fires and 1,643 more man-caused fires than in 1937.

There were 102,671 more acres burned. Damage to tangible values was $324,970 greater. Fire-fighting expenditures exceeded those of 1937 by $1,359,917, and there were 11 more fires that got bigger than 300 acres. By comparison with 1937, the 1938 record was unfavorable. So were weather conditions, including an unusually bad concentration of dry lightning storms. But 1938 emphasized the fact that although methods of rating fire danger and discovering and extinguishing small fires are relatively well advanced, prevention of man-caused fires and suppression of large ones lag.

These are now the weakest links in the chain of effective fire control. Suddenly to recruit several thousand men at labor centers, and to transport, organize, and manage them effectively on a fire, is like attempting to repel an unexpected armed invasion with the aid of a limited force of trained personnel. It is, of course, impracticable to maintain trained men in numbers adequate to combat all the fires that may escape from regular fire-control forces at unpredictable times and places. But there is urgent need for financial resources that will permit a longer period of employment—it is now only about 4½ months each year—for fireguards, who are the backbone of trained fire-fighting personnel.

Search for more effective ways of combating the occasional fire that gets away is being made. One experimental 40-man special crew has been organized. Under trained leadership this crew will attack all larger fires within striking distance of its base camp in southwestern Oregon. Experiments will be continued with (1) delivery of food to men on fire lines, (2) developing methods of organizing workers for fast construction of successful fire lines, and (3) dropping men by parachute to inaccessible fires before they get large.

Since the New England hurricane of last September (p. 19), there are thousands of acres of bad blow-down on the White Mountain National Forest, in New Hampshire, through which it may take a man an hour to worm his way a quarter of a mile. Hazard-reduction work has been done there. Because of widespread timber-salvage work, skilled woodsmen are available in larger numbers than usual. But there is grave danger that fires may escape and make devastating runs before they are finally corralled. To help meet this situation hazard-reduction crews are bunched for test runs, and methods of control-line construction, modified to meet eastern conditions, have been adopted.

PROTECTION FROM INSECTS AND DISEASES

Serious epidemic infestations of tree-killing bark beetles were experienced during the year in national forests in Idaho, Montana, Colorado, Wyoming, and Utah. Lesser attacks were recorded in

other Western States. No extraordinary infestations occurred on national forests in the Lakes States, the East, or the South.

Measures were successful in reducing major epidemics, but as is normally the case, additional work will be needed on many areas. During the year, 624,937 acres were covered in insect-control work. This involved treatment of more than 86,000 trees. Excellent cooperation was given by the Bureau of Entomology and Plant Quarantine. Close working relationships with this Bureau in connection with both insect control and white pine blister rust control are in large measure responsible for results obtained.

Progress was made in the war on white pine blister rust. Chief theaters of action were again in northern Idaho, eastern Washington, and the California-Oregon sugar pine region. The year's work brought the total area which has been given initial treatment to 2,288,251 acres, but 1,522,467 acres of susceptible-pine timberlands, in the path of the disease, have not been touched. The rust is established in this area, and is killing young pines that should form the basis for future commercial timber crops. Repeat treatments must be made on many areas if initial control investments, and future forests, are to be safeguarded. Work of this character has covered 342,309 acres.

C. C. C. and W. P. A. crews are used in insect- and disease-control projects to the limit of their availability. The war on the serious blister rust threat to future timber supplies in Montana, Idaho, Washington, Oregon, California, must be fought in inaccessible country, during the short summer season. Mobilization and use of emergency labor is inadequate. It is supplemented by crews of local men paid from regular funds. But like epidemics among human beings, white pine blister rust spreads rapidly. It must be hit hard, and without a let-up, if adequate control is to be assured.

Development and Administration

BESIDES protecting the national forests from fires, insects, and diseases, Forest Service stewardship involves developing and administering these properties—including their land, water, timber, forage, wildlife, and recreational resources and the services they perform—in the public welfare. Progress is summarized in the following pages.

LAND

Among processes which through land management are essential to planned and correlated resource use, are:

Surveys and maps.—The Forest Service uses two methods to secure map data for national-forest areas for which it is not yet

available. One is aerial photography. The other is topographic and drainage surveys. The former was used to cover 14,417 square miles, and the latter to cover 7,961 square miles during the year. Forest Service mapping conforms to standards of the Federal Board of Surveys and Maps, and is integrated with the work and programs of that Board.

Highways, roads, trails, landing fields.—Besides emergency landing fields, the national-forest transportation system as now planned includes 24,817 miles of forest highways, 114,743 miles of forest-development roads, and 154,791 miles of horse and foot trails. Including progress made during the year, percentages completed to satisfactory standards are 50, 45, and 71, respectively. In country inaccessible to roads there were 66 emergency landing fields ready for use by the end of the year. Funds allotted for construction and maintenance of highways, development roads, and trails, by States, are included in section Z of volume X, Administrative Statistics (p. 48).

Settlements, claims, special uses.—There were 43,031 active special-use permits for small areas of national-forest land as of June 30, 1939. They were issued for such purposes as summer homes, pastures for domestic stock, drift fences, roads, resorts, and the like. Rental was charged on 23,411 of them, and 19,620 were issued free. Special-use receipts for the year totaled $365,025.95.

Final applications for homestead patents during the year totaled 79. Favorable reports were issued by the Forest Service on 63, and unfavorable reports on 16 of them. Of the 100 final applications for mineral patents to national-forest lands, 74 were reported upon favorably and 26 unfavorably by the Forest Service.

WATER

Water is a necessity for domestic purposes, for irrigation, and for power. Uncontrolled at its sources, it causes erosion and floods. They are recurring national menaces.

We need man-made structures of concrete, steel, and earth to confine and regulate angry waters. We also need to supplement them with land-management measures that hold water back from rivers by conditioning soil so it will absorb more rainfall.

Porous forest soils (p. 17) do this. That is one reason why national forests were established on headwaters of most major streams west of the Great Plains; why additional national forests have been created in the East on watersheds of many navigable streams and at many sources of supply for water used for power and for domestic purposes.

General Forest Service activities with respect to the water resource and flood control have been described briefly. So have efforts to pre-

serve forest and vegetative cover on national forests by protecting them from fire, insects, and diseases. Methods used to help prevent erosion and floods by regulating timber-cutting and grazing by domestic livestock, and by planting, will be found on pages 41 and 42. Action on a departmentally coordinated watershed flood-control program has not as yet been initiated but $29,000 from the Department's flood-control funds has been authorized to meet an emergency on 11,000 acres denuded by forest fires on steep headwaters of the Santa Ana and San Gabriel Rivers in southern California. This denudation set the stage for calamitous floods in the populous valleys. Emergency treatments, including sowing of mustard, channel rectification, and minor engineering stabilization work, have been undertaken to help prevent damaging run-off, slides, and mud-rock flows.

Authority to issue licenses or permits for operation of electric power distribution lines in national forests now rests with the Federal Power Commission. There are, however, 162 active permits and easements issued by the Forest Service prior to the passage of the Federal Water Power Act. Of these there are 85 for power-generation projects with a combined estimated average low-flow output of 331,991 horsepower and a combined estimated installed capacity of 678,537 horsepower. There are also 77 permits for transmission-line projects with a length of 703.4 miles within national-forest boundaries. During the year annual rental fees were charged on 52 power projects (estimated low-flow output 316,344 horsepower) and 67 transmission-line projects (length, 636.3 miles). No rental fees were required on 33 power projects (estimated low-flow output, 15,647 horsepower) or on 10 transmission-line projects (length, 67.1 miles).

In assisting the Federal Power Commission in administering the Federal Power Act, the Forest Service at the end of the fiscal year was supervising the operation of 428 permits and licenses. Of the total applications received by the Federal Power Commission from all sources during the year, 80 percent, or a total of 81, involved the use of national-forest land.

TIMBER

There are 175,843,405 acres of Federal land in the national forests. In round figures this includes 134 million acres of forest land and approximately 41 million acres of intermingled grass, browse, and alpine country. Of the forest land, also in round figures, 88 million acres are capable of producing commercial timber under present or reasonably conceivable future conditions. But estimates indicate that only about one-third of the saw timber now in national forests

could be logged at a profit under present operating and marketing conditions.

In part because of the urge for quick liquidation, more than 95 percent of the forest products produced in the United States each year comes from privately owned forest lands. Since less than 5 percent comes from national forests, cutting operations on them are confined to a relatively small part of their accessible commercial forest land. There are as yet only 3.4 million acres under intensive sustained-yield forest management in the national forests, with 33.3 million acres under extensive sustained-yield management. Plans have been prepared for additional areas, and management will be extended as rapidly as additional cutting is economically feasible.

Timber sold and harvested.—Sales of national-forest timber are encouraged where woods and mills operations will help support local and dependent families and communities, and where regulated cutting will increase the growth and quality of the remaining stand. Large sales are made under this policy, but most sales are relatively small.

There were 22,717 national-forest timber sales made during the fiscal year. Stumpage involved in them was equivalent to 1,842,342,000 feet b. m. The net volume involved in exchanges (p. 34) was equivalent to 418,251,000 feet b. m.

Timber actually cut under sales and under land exchanges was equivalent to 1,017,269,000 and 273,292,000 feet b. m., respectively. Receipts collected for sales of timber, forest products, and as settlement for timber trespasses, were $2,857,211. Timber worth $690,636 was delivered in exchange operations. It is estimated that the equivalent of 269,233,000 feet of timber was given away. This includes dead and down trees customarily granted free to local settlers for personal use.

Planting.—During the calendar year 1937 the Forest Service operated 26 national-forest nurseries. In 1938 it operated 27. In 1937 the nurseries furnished 136,809,000 trees. They were used to plant 155,744 national-forest acres, and to supply other Federal agencies and States with 10,357,000 trees. During 1938 the nurseries furnished 139,218,000 trees. They were used to plant 154,993 acres in the national forests, and supplied 7,008,000 trees to other Federal agencies and (p. 13) States.

On December 31, 1938, there were 814,867 acres of plantations on national forest lands. The total acreage planted in 28 years, including replantings, is 1,082,348, or an annual average of 38,655 acres. Despite the large amount of work done in recent years by the C. C. C. (p. 29) there are in the national forests 3,600,000 acres that must be planted if they are to be made productive again. At the average rate of progress, this will take 96 years.

FORAGE

Four and a half million acres of crop-producing lands and 22 million acres of range lands in private ownership, representing livestock and ranch investments of around $200,000,000, are definitely related to and dependent upon national-forest grazing resources in Western States. Eighty million acres in national forests are used by domestic livestock.

Permits and numbers of stock.—On the national forests, in the calendar year 1938, there were grazed under pay permits 1,220,532 cattle, 29,543 horses, and 126 swine belonging to 19,006 owners; and 5,300,140 sheep and 7,160 goats belonging to 5,478 owners. The number of permittees was 3 percent lower than in 1937, and there were 3 percent fewer stock, but there was an increase over 1937 of 3 percent of the cattle and 5 percent of the sheep grazed under term permits.

In addition, 39,105 cattle, 44,661 horses, 16,349 swine, 10,586 sheep, and 4,833 goats used national-forest ranges under the regulation authorizing free grazing permits for the few livestock in actual use by prospectors, campers, and travelers, those used in connection with permitted operations on national forests, and not more than 10 head of milk or work animals used by any one person for domestic purposes.

Reductions, trespasses, losses.—Reductions for range protection in western national forests totaled 8,818 cattle and horses, and 28,477 sheep and goats in 1938. Reductions for distribution totaled 472 cattle and horses and 2,675 sheep and goats. There were 11,672 cattle, 50,497 sheep, and an estimated 3,000 horses in trespass on western national forests at one time or another during the year.

Livestock losses due to poisonous plants, predatory animals, disease, and other causes totaled 15,827 cattle and 149,183 sheep. This was less than the previous 5-year average. Poisonous plants were the greatest single cause of cattle losses. Predatory animals accounted for the major part of the sheep losses.

Rodent control.—Rodent-control work under the cooperative direction of the Bureau of Biological Survey was done on 788,700 acres during 1938. A large acreage is still badly infested. Follow-up work is an essential factor in effective controls.

Grazing fees, limits.—For 1939, based on 1938 market prices, grazing fees average 11 percent lower for cattle and 22 percent lower for sheep than the 1938 fees. Tentative policy regarding limits was discussed with a joint committee of the two national livestock associations in July 1938. Out of this and subsequent meetings throughout the West came regional recommendations which were correlated in the Washington office. Although the limits approved

do not attain complete uniformity, with minor exceptions they were supported by a strong majority vote of the stockmen concerned.

Local livestock associations.—There was mutually helpful cooperation with 768 local livestock associations during 1938. All of them elect their own officers. Officers and associations are independent of the Forest Service, but to facilitate cooperation 729 associations—an increase of 10 over 1937—qualified for recognition under advisory-board regulations. Cooperation through local stock associations deals largely with current management on individual ranges used by member permittees.

Range surveys.—Some 3,835,015 acres were covered by intensive range surveys during the calendar year 1938. Of this, 1,473,673 acres were done by aerial surveys. This brings the total aerial surveys to date to 7,837,752 acres and the grand total of intensive surveys by all methods to more than 50,000,000 acres. In addition, extensive surveys totaling 17,972,000 acres had been recorded by the close of 1938. Acreage in extensive surveys is dropped from the records as coverage of the same areas is made by more accurate intensive methods.

Range management, and A. A. A. range-conservation program.—A committee of range specialists revised instructions for preparation of range-management plans, which are now being tested in the field. A Forest Service range specialist, assigned to the A. A. A., continued technical supervision of the range-conservation program under the Soil Conservation and Domestic Allotment Act.

WILDLIFE

The national-forest wildlife resource may be summarized as follows:

Big game.—As of January 1, 1939, estimates placed the total number of big game at 1,841,000. This is an increase of 170 percent since 1924. Deer—there are 1,584,000 of them—are to be found on all the 158 national forests. There are 140,000 elk on 95 forests; 58,000 black bear on 134 forests; 18,300 mountain goats on 30; 18,100 antelope on 35; 10,100 bighorn sheep on 57; and 7,280 moose on 31. Alaska brown, and grizzly bear now number 5,190 on 28 national forests. The former are found on the 2 national forests in Alaska; the latter on 28 national forests.

Fur bearers.—Estimates indicate 2,340,000 fur bearers of miscellaneous species. They could be increased without major conflicts with other national-forest uses and values.

Birds.—An unestimated number of game, nongame, and insectivorous birds.

Fish.—There are approximately 70,000 miles of good trout streams and thousands of natural and artificial lakes and ponds suitable for

game fish in the national forests. Forest officers planted or supervised the planting of over 180 million fish in 1938. During the 6-year period 1933–38, 831,253,500 fish were planted by or under the supervision of forest officers. The C. C. C., State, and other agencies also planted many fish in national-forest waters.

Wildlife refuges and sanctuaries.—Within national forests there are 36,534,713 acres in 661 wildlife refuges and sanctuaries.

Wildlife values.—National-forest wildlife provided attractive hunting and fishing last year for some 4,249,000 people in the continental United States, and about 24,000 in Puerto Rico and Alaska. Positive annual wildlife values for national forests are estimated at more than $100,000,000.

Wildlife management on the national forests recognizes recreational, esthetic, and educational, as well as economic values of this resource. It deals with such problems as those arising from grazing by domestic livestock, harvesting the timber crop, and needs for highways, roads, trails, and airplane landing fields to help protect forest and forage from damage and destruction by fire. It maintains cooperative relationships with the States, with such Federal agencies as the Biological Survey and the Bureau of Fisheries, and with sportsmen's associations, livestock organizations, nature societies, and educational and research institutions of various kinds.

With increases in herbivorous game, a number of problem areas have developed where available winter, early spring, and late fall ranges are not in balance with available summer ranges. The past year has recorded distinct accomplishments in the recognition of overstocking problems by States, sportsmen's associations, and other agencies. More game lovers and game officials have come to believe that wildlife in this twentieth century is a matter of management within available range limitations; that over the great bulk of its range, wild game as well as domestic stock must have human attention and control.

RECREATION

The national forests include 175,843,405 acres of public land. On the basis of a total population of 130 millions, each citizen's share is a little larger than a football gridiron. But the national forests belong to all the people, and the Forest Service is charged to administer all its resources and uses in such ways as will increase the wealth and happiness of the greatest number in the long run.

One use of this vast estate is for human recreation. Millions of people come to it, each year, for an hour or a day or a series of days of rest, of relaxation, of inspiration, of seclusion, or of sport. Among

these people are those who live in cities and never saw the wild before; others who live on the prairies and never heard the wind sigh through tall pine trees; still others who long for a change from their lives by the sea.

Among all these people, too, are those with ample and those with scant means; those who can afford mountain and forest hotels, resorts, and dude ranches; others who must plan long and carefully if wives and children are to find, once each year at community or free public campgrounds, relief from summer temperatures that at home may exceed 100° F. during the day and 90° at night.

The natural and the primitive.—National forests help protect the water resource and yield annual crops of timber and forage. But they also yield repose and joy. And since there are plenty of complex and clamorous amusements available to most people elsewhere, every effort is made to preserve a spacious and a natural air in developing national-forest recreational opportunities and facilities. The aim is to keep such facilities simple, inexpensive, and natural; as nearly as possible accessible to all, but with ample areas within which conditions of transportation and vegetation approaching the primitive are maintained.

Under this policy, development of such facilities and structures as will aid in the enjoyment of those types of recreation appropriate to the forest is encouraged. And preference is given to developments that provide opportunities for participant rather than spectator enjoyment of recreation activities.

Variety.—There are in the national forests hot, dry woodlands of pinon and juniper, and alpine forests and meadows which during part of the year are saturated with the snow and rain and mist of mountain tops. There are abused, cut-over lands purchased by the Government to restore them to productivity, and virgin forests as untouched by commercial cutting as they were before the days of Columbus. In the Southeast and the Southwest and the Black Hills are forests so devoid of water bodies as to require artificial lakes and reservoirs. In northern Minnesota and Wisconsin there are forests with so many thousands of lakes that no one has ever counted them all. There are waterfalls, dry mesas, turbulent rivers, and merry little streams. There is timberland, range land, rock land, and desert land. There is an infinite variety of trees and shrubs and flowers, and millions of big game animals, fur bearers, and other wildlife.

This, in brief, is a picture of the national-forest estate within which more than 32¾ million visits were made by people who, from every State in the Union, sought and found rest, relaxation, and recreation there in 1938.

Appropriations, Expenditures Auditing

SINCE Forest Service responsibilities and activities extend beyond the national forests, so do funds allotted to and expended by it. For the fiscal year 1939 they include, for example, expenditures from appropriations and funds as follows: Cooperation with States and private agencies in fire control, planting, and forestry, $2,153,327; contributions by States, counties, associations, and individuals for fire control, slash disposal, improvement work, etc., $2,097,842; for fire control in New England as a result of the hurricane there, $471,198; work relief including C. C. C. expenditures for camps on State and private lands, for camps located on lands controlled by other Government agencies, and for national-forest camps, $35,050,476; research $2,053,334; other Government agencies, $665,229; and $641,525 miscellaneous, including repayments of deposits. Expenditures for protection, management, development, and extension of national forests were $31,721,193. This included, in part $8,354,603 for forest highways (expended by Public Roads Administration), and $2,732,237 for acquisition of additional forest lands from regular appropriations.

Funds to carry on Forest Service activities during the fiscal year were derived from 42 appropriations, and were grouped in six broad classes. Funds were allotted to units and subunits by appropriation objects or purposes. Each unit maintained accurate records by funds and by projects, purposes, and objects. Encumbrances and expenditures were confined to amounts and purposes authorized. Administrative controls and detailed budget and accounting records were maintained, and with independent auditing were extended to the 10 regional offices, 12 experiment stations, Forest Products Laboratory, Prairie States and New England projects, 155 forest offices, 785 ranger districts, 16 State C. C. C. offices, and numerous C. C. C. camps.

In addition to accounting and fund-control records, expenditures are broken down, without reference to appropriations, into 40 major cost-accounting captions. These reflect the actual use of appropriated funds in connection with individual resources. They, and cost records kept by projects, supply the cost data used in administration and that required by the Secretary, the Bureau of the Budget, Congress, and other agencies.

Total expenditures for all purposes by the Forest Service during the fiscal year were $74,854,124. Receipts were $4,903,376, of which $1,215,925 was, under existing legislation, returned to the States.

New Legislation

THE first session of the Seventy-sixth Congress extended beyond June 30, which was the end of the fiscal year 1939. Legislation that, enacted during the entire session of this Congress, affects the Forest Service, includes:

APPROPRIATION ACTS

Department of Agriculture, act of June 30, 1939 (Public, No. 159), makes regular appropriations for fiscal year 1940.

First Deficiency Act of March 15, 1939 (Public, No. 7), includes $500,000 for protection and management of the White Mountain National Forest, in New Hampshire and Maine, and $5,000,000 for protective improvements, reduction of fire hazard, and prevention of fires on non-Federal lands (p. 20).

Second Deficiency Act of May 2, 1939 (Public, No. 61), includes $2,480,000 for emergency fire fighting, fiscal year 1939.

Independent Offices Appropriation Act of March 16, 1939 (Public, No. 8), appropriates $295,000,000 for the C. C. C., fiscal year 1940, of which approximately $26,000,000 is to be allotted to the Forest Service.

Emergency Relief Act of February 4, 1939 (Public Res. No. 10); Emergency Relief Act of April 13, 1939 (Public Res. No. 10), appropriate $725,000,000 and $100,000,000, respectively, additional fiscal year 1939, of which $2,005,768 project funds and $135,000 administrative funds were allotted to the Forest Service. These amounts, added to previous allocations of emergency relief funds, brought the total allocations for the fiscal year 1939 to $6,843,123 project and $375,000 administrative funds.

Emergency Relief Act of June 30, 1939 (Public Res. No. 24), appropriates $1,477,000,000, together with unexpended fiscal year 1939 balances, for fiscal year 1940, of which $5,859,945 project funds and $234,000 administrative funds are to be allotted to the Forest Service.

War Department Civil Appropriation Act of June 28, 1939 (Public, No. 154), includes $133,000,000 for flood control, $3,000,000 being for transfer to the Department of Agriculture, a portion of which will be expended by the Forest Service.

OTHER ACTS

Act of April 3, 1939 (Public, No. 19), to provide for reorganizing agencies of the Government.

Act of June 6, 1939 (Public Res. No. 19), authorizing the acceptance of certain lands on Government Island, Calif.

Act of June 13, 1939 (Public, No. 125), to amend the mining laws applicable to the watershed on the headwaters of the Bonito River, Lincoln National Forest, N. Mex.

Act of June 30, 1939 (Public, No. 163), to extend the time within which annual assessment work on mining claims may be commenced.

Act of July 20, 1939 (Public, No. 199), to authorize the creation of new national forests in Montana.

Act of July 27, 1939 (Public, No. 240), for the protection of the water supply of the city of Ketchikan, Alaska.

Act of August 7, 1939 (Public, No. 326), to amend the act establishing the Civilian Conservation Corps.

Act of August 10, 1939 (Public, No. 374), to include within the Kaniksu National Forest, Wash., certain lands owned or in the course of acquisition by the United States.

Act of August 11, 1939 (Public, No. 394), to authorize the addition of certain lands to the Wenatchee National Forest, Wash.

House Concurrent Resolution No. 11, March 31, 1939, continuing the Joint Committee on Forestry.

Administrative Statistics

THE practice of compiling certain basic statistical material in tabular form and making it available separately from the annual report, rather than as a part of it, was inaugurated in 1938. This practice made such material readily available for wider use, and resulted in definite savings. It is, therefore, continued.

Section Z of volume X, Administrative Statistics, is multilithed on paper approximately 8 by 10½ inches in size. It includes more detailed data than has been incorporated in this annual report. Copies may be obtained on request from the Forest Service, Washington, D. C.

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REPORT OF THE CHIEF OF THE BUREAU OF HOME ECONOMICS, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF HOME ECONOMICS,
Washington, D. C., September 16, 1939.

HON. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the Bureau of Home Economics for the fiscal year ended June 30, 1939.

LOUISE STANLEY, *Chief.*

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TOWARD HIGHER LEVELS OF LIVING

Higher levels of living for the people of the United States—those in cities and villages as well as those on farms—is the ultimate goal of the program of the Department of Agriculture. Provision of a continuous and abundant supply of food and other farm products for all of the Nation's families is one of its major objectives; more stable and adequate incomes and greater security for farm families, another. Work toward these goals may be indirect, as through programs of soil conservation and flood control; or it may be direct, as through the rehabilitation program, and the work of the Consumers' Counsel and the Bureau of Home Economics. However, approached directly or indirectly, a concern for human welfare guides the formulation of research and action programs throughout the Department.

The contribution of the Bureau of Home Economics in this program follows two major lines—furthering the well-being of all people through more effective use of foods and other agricultural products; working toward the solution of special problems of improving the living of farm families. More adequate diets for the Nation's families to help maintain and improve health; better housing, based on knowledge of the dwelling in relation to wholesome family life;

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wise use of household equipment; better use of income and increased satisfaction through widespread understanding of household buying problems; greater security for families through wise management of family finances—these are the objectives upon which the Bureau's research program is built.

Because of the close relationship between food-consumption habits and health, agriculture is concerned that its food production program should promote better human nutrition. The Bureau of Home Economics makes an important contribution by studies to determine what people need in terms of essential nutrients (such as proteins, vitamins, and minerals) and how much of each; what foods will provide these essentials in adequate amounts; the dietary habits of people—what foods they commonly use and in what quantities; whether customary diets are adequate from the standpoint of nutritional needs; how people may be helped to improve their habits of food consumption.

The quality and the composition of foods are affected by agricultural production practices and conditions. The Bureau of Home Economics, in cooperation with other bureaus in the Department, investigates the many and varied factors that influence the nutritive properties and the quality of food, in order that producers may better meet consumers' needs and preferences. New uses of food products, better methods of food preservation, and improvements in household practices of cooking foods are also studied in order to help homemakers serve better meals.

To provide clothing and household textiles for the Nation's families, cotton and wool, two of our important agricultural products, are needed. The Bureau is studying ways of increasing consumers' satisfactions from the use of cotton and wool garments and thereby increasing consumer demand. For example, ways of manufacturing cotton hose so that they have greater elasticity and better finish and style have been the object of a special study this year. Other research is designed to help homemakers buy clothing and household textiles best suited to their families' needs, tastes, and pocketbooks. Thus, to help mothers obtain garments that fit children, a study has been made of measurements of boys and girls—as height of waist and girth of hips—to serve as a basis for standards for the sizes of their garments.

Families want durable sheets and blankets that are warm and wear well; hence the Bureau studies the qualities of cotton and wool fibers that make for serviceability of such articles. Construction of fabric as shown by the number of yarns per inch also is investigated since this affects durability. Findings of such research, to be of aid to the household buyer, should be used by producers in establishing minimum standards of quality and market grades for consumer goods, and as a basis for informative labels. In order to provide such buying guides, the Bureau works with other agencies interested in consumers' standards, as the American Standards Association and the American Society for Testing Materials.

Housing needs of families have received far less attention from research workers than have needs for food. The Bureau's research provides valuable information as to the present situation, such as the size of farmhouses, their state of repair, the number of unused rooms,

number of persons per room, and the proportion of families at different income levels having such modern facilities as running water, electric lights, and central heating. What farm homemakers wish in the way of improved living quarters, their suggestions for type of house, arrangement of work centers, storage space, and special features that will meet the demands of the farm business, have also been obtained. However, there is need for research as to how houses may function more adequately; how they may contribute to the development of well-adjusted, happy people; what are the most effective uses of housing space when construction costs are high; what size and shape of rooms are best suited to the many and varied family activities. A study of farm kitchens, now under way, is of this type; its purpose is to determine how much space is needed for the tasks commonly carried on by the farm family in this important room, and the arrangement of work spaces and of equipment that will facilitate the performance of these tasks.

Closely associated with problems of housing are those of household equipment since both affect the efficiency with which homemaking tasks are done, the time and energy spent in doing them, and the family's comfort and well-being. Thus, the character of family meals is affected by the equipment available for their preparation. The homemaker with heavy responsibilities for laundry work, mending, and other types of household production saves strength and health if she has labor-saving devices. In purchasing her household equipment she is in especial need of buying guides if she is to obtain products that will accomplish the work to be done, at an expenditure within the financial means of her family. Research of the Bureau is designed to serve as a basis for formulating standards for household equipment of various sorts as aids to household buyers and for providing instructions as to ways of using equipment more efficiently.

The level of living a family can achieve is limited by its income. However, incomes of farm families are not so inflexible as they may seem; through budgeting, production for family use, and other wise management practices, family funds may be made to yield far greater satisfactions than if hit-or-miss ways of spending are followed. As a basis for sound family plans for management of money and other resources, the Bureau studies family consumption, the kinds and quantities of goods and services used by families, both those purchased and those home-produced. Such studies not only serve as guides to the individual family; they also provide information as to present and potential markets for products of both agriculture and industry and are widely used by producers.

The diets of many of the families of this country, as shown by such consumption studies, are inadequate. While limited funds are responsible, in part, for this situation, poor food choices also are a factor. The Bureau and other agencies in the Department are using facts from these dietary studies in their educational program designed to help families select food more wisely. Improvement of food habits would benefit the Nation's health and would also call for increased use of agricultural products such as vegetables and fruits, milk and other dairy products.

Careful planning for use of land by the individual farm family often enables it to produce a considerable share of its food supply and thus improve its diet. In addition, by saving on grocery bills the family can spend more for other items of living. The Bureau's research has provided the basis of plans for family food production now being used in the education programs of the Extension Service and the Farm Security Administration.

Agricultural policies designed to decrease farm tenancy and to increase ownership of farms by the families of operators also should utilize these studies of family income and consumption if they are to succeed. All too often, in the past, families have been unable to carry out plans for land purchase because they did not provide for meeting both living expenses and payments on the loan. Unless the family can have a decent living while a mortgage is being amortized, the family members are likely to become discouraged and leave the land.

The Bureau's studies of family consumption by income level thus provide information of fundamental importance to many other groups in this Department, as well as to other governmental, social, and business agencies whose policies and programs are concerned with the adequacy of incomes of families, their financial security, use of credit, ability to buy goods and services, and their market preferences, as shown by their buying habits.

Findings from the more important of the current research projects of the different divisions of the Bureau are given below, together with their implications in the broad program of helping all families to raise their levels of living through better planned use of income, more efficient buying, and wiser consumption.

ECONOMIC STUDIES

Modes of farm-family living are changing along with methods of agricultural production, as technological advances occur. These changes are largely in the direction of urban patterns of living. Yet differences between farm and city groups persist and probably will continue, owing in part to differences in the agricultural and industrial economies. The Bureau has been able to study differences between the kind of living achieved by families of farm operators and that achieved by families in villages and small cities as a part of the study of consumer purchases (a large-scale investigation of consumption patterns of families on farms, in villages, and in cities, carried out cooperatively by this Bureau and other Government agencies as a project of the Work Projects Administration).

FARM AND CITY INCOMES

In any such comparison differences in the composition and income levels of farm and urban groups must be recognized. Farm families are larger; 42 percent of those in the United States had five or more members in 1930, as compared with 26 percent of the city families, according to the census. More than one-third, 36 percent, of the rural farm population were under 15 years of age; only 26 percent of the urban. Families on farms, as a group, therefore, are carrying heavier responsibilities for the upbringing of the Nation's future

citizens than are those in cities—a fact that affects their ways of living and their uses of income.

The general income level of all families living on farms (operators and laborers) is lower than that of city families. According to estimates of the National Resources Board based largely on the consumer purchases study, half of the nonrelief families living on farms had incomes below $965 in 1935–36, while the median income of nonrelief families in small cities was $1,290. Families of farm operators had higher incomes, more nearly equal to those of small-city families than were those of the entire farm group.

The form of the income received by farm and city families differs, too. Incomes of the former are in cash and in kind, while those of the latter are in money, for the most part. Although home-owning urban families have some nonmoney income from occupancy of their houses, such income is considerably less than the income received by farm families from housing, food, fuel, ice, and other products the farm provides. With a smaller proportion of the total in the form of cash, the income of the farm family is much less flexible, as a medium for purchasing goods in the market, than is that of the city family. However, the advantage is not all on one side. The nonmoney income of the farm family tends to safeguard a minimum level of living even in a low-income year. In a period of prices unfavorable for the sale of farm products, the food the family has raised for its own use, the dwelling, and the fuel supply provided by the farm have a use value equal to that of years of higher prices. The city family, which must buy practically all its living, no matter how low its money income, has no such safeguard.

Participation of family members in the farm business tends to develop a strong interest in its success and a willingness to curb expenditures for living in order to purchase land and otherwise build up the enterprise. Farm families, therefore, begin to save at lower income levels than do urban families. At any given income level above $1,000, relatively more families of a farm than of a city group keep their expenditures for living below total net income, and the average surplus of the farm group is higher. For example, according to the data from the consumer purchases study for the Middle Atlantic and north-central region, a group of farm families in the income class $1,000–$1,249 had an average surplus of $26 over expenditures while the city families at this level were "in the red". When incomes fell within the range $4,000–$4,999, the average surplus of the farm families was $2,182; that of the families in small cities, $1,183. Spending-saving patterns of the farm and small-city groups in other regions showed similar tendencies, though in farming sections near urban centers differences between the two were less marked.

USE OF MODERN CONVENIENCES

With more children to be reared, generally lower income levels, a smaller proportion of net income in the form of money, and a stronger interest in savings, farm families have restricted their purchases of industrial products more than have city families. Environmental factors which make some of these products far more expensive for farm than city groups, have tended to further limit their buying.

Electricity, for example, can be brought to the city home much more cheaply than to the isolated farm. It is not surprising, therefore, that electricity is serving far more urban than farm families—98 percent of the small-city families and 47 percent of the families of farm operators surveyed by the consumer purchases study in the north-central region. The proportion of city families using electricity was similar in the other regions; but the proportion of farm operators' families ranged from 8 percent in Mississippi and Georgia to 95 percent in California. This survey provided a representative sample of the native-white, unbroken, nonrelief families in the communities studied; their incomes were somewhat above those of the population as a whole, since Negroes, foreign-born and other low-income groups were excluded. The farm families discussed in this report are those of operators only. These figures for electricity, therefore, and figures given subsequently present a somewhat more favorable picture than would data for all farm or all urban families.

Improvements in transportation and communication usually are classed among the greatest of the gifts of technology to present-day living. That farm families are by no means reluctant to use these gifts, if they may be had without expenditures far above those made by city families, is shown by figures for automobile ownership. In the north-central region, automobiles were owned by 94 percent of the farm families surveyed, as compared with 70 percent of those in small cities. The farm families practiced economy in car buying, however; almost three-fourths of the automobiles they bought came from the used-car market, while half of those bought by the city group were new.

Other products lessening the isolation of the farm family are widely used when easily available. Thus, in the north-central region the proportion of farm and small-city families having daily newspapers was almost the same—90 and 93 percent. Similar proportions were reported in other farm areas that were only a few hours distant from large cities; but in the cattle-range area, where newspapers would be a day old before they reached many of the farm families, only about half, 53 percent, were subscribers to dailies.

Telephones had been installed by 52 percent of the farm families and by 60 percent of those in the small cities of the north-central region. In the Southeast, only 5 percent of the native-white families of farm operators as compared with 49 percent of the city families had this convenience.

That radios—another source of news—were owned by comparatively fewer farm than city families seems to be related more to lack of electricity than to income differences. While 90 percent or more of the small-city families had radios in the north-central, plains and mountain, and Pacific regions, the proportion of farm families reached this figure only in the California area where more than nine-tenths had electricity. In the Southeast, as few as 31 and 40 percent of the families of white operators in the two areas had radios; in the other regions the proportion tended to be about three-fourths to four-fifths.

A comparison of the housing of farm and urban groups shows the former ahead in some respects, lagging behind in others. Houses operate than others. There may be little correlation between the

north-central region, 93 percent of the farm homes had 6 or more rooms, as compared with 52 percent of the city homes. Average number of rooms per farm dwelling was 8.02; per city dwelling, 5.7. Even though farm families were larger, average number of persons per room was smaller, 0.54 as compared with 0.63 in the small cities. The farm family apparently has more space for living, indoors as well as outdoors.

But farm homes suffer by comparison with those of city families when the so-called modern facilities are considered. Only 24 percent of the farm families in the north-central region had running water: even fewer, 10 percent, running hot and cold water in both kitchen and bathroom. In contrast, 94 and 71 percent, respectively, of the small-city families had these conveniences. However, cities provide water and sewage systems, available to every dwelling with only a comparatively small money outlay, while each farm family must provide these at its own expense.

More farm homes are heated by stoves than by central heating systems; the reverse is true in the small cities. In the north-central region, 40 percent of the farm dwellings and 68 percent of those in small cities were equipped with central furnaces. Without adequate heat, some rooms of the farm home are not usable in winter, and there then may be as much crowding as in the smaller city houses.

The farm home still harbors many of the household-production activities that city families have turned over to industry. Thus, in the north-central region, 3 percent of the farm families had their laundry done out of the house, as compared with 24 percent of those in small cities. Almost all, 99 percent, of the farm homemakers, but only 49 percent of those in cities, canned food for their families. Farm homemakers also share in such farm business activities as grading and selling eggs and keeping the farm records. Because of the many demands on their time, rural women are more in need of labor-saving devices than are city homemakers.

Equipment operated without electricity and of unquestioned service in household production is as widely used by farm as by city families. In the north-central region, 85 percent of the farm homemakers had sewing machines as compared with 72 percent of those in the small cities. Washing machines were owned by 79 percent of the former and 72 percent of the latter. Fewer than one-fifth of the machines in the farm homes were hand-driven, doubtless because mechanical types not demanding electricity were available. Refrigerators of the usual types are not usable in farm homes, far from established ice routes or without electricity or gas. Only 29 percent of the farm families as compared with 81 percent of those in small cities of this region had refrigerators of any sort; 8 percent of the former and 35 percent of the latter families had mechanical refrigerators.

Farm families tend to spend less on clothing than urban families. Differences in expenditures reflect differences in the standards of dress: apparently families in cities place clothing higher in their scale of wants than do those on farms. Thus, in the north-central region, farm families who were in the income class $1,000–$1,249 and had two children under 16 years of age spent an average of $80 for their year's clothing; city families of similar income and compo-

sition, $105. The desire to keep up appearances seems to be more potent in determining how family funds will be spent in cities than in farm communities. The higher clothing expenditures of the urban group, the greater proportion of purchases of new rather than used automobiles, the greater expenditures for personal care—services at beauty and barber shops and for toilet articles and preparations—give evidence of this difference.

PATTERNS OF INCOME USE

Farm families are the best-fed population group in the country, and village families, the poorest. City families fall between the two, in the proportion having adequate food, according to an analysis of dietary records from the consumer purchases study. The difference between diets of farm and small-city families tends to lie in the "protective" foods. Farm families consume an average of about 60 percent more milk, 15 percent more butter, and 25 percent more leafy, green, and yellow vegetables than small-city families. Farm diets, therefore, tend to be richer in protein of high quality, in vitamin A, in iron, and in calcium.

While not all farm families are well fed, many are able to have excellent diets because they produce for home use generous quantities of a large variety of protective foods. Each family should learn what foods and how much of each is required to furnish a fully adequate diet. Popular bulletins of this Bureau and the teaching of the Extension Service and Farm Security Administration help provide such information. After estimating its food requirements, a family should decide what to buy and how much, what to undertake to raise and how much, and what to can and store for out-of-season consumption.

If the diets of all families now inadequately fed were raised to accepted standards of adequacy, the national consumption of the protective foods would be increased as shown below, according to conservative estimates:

	Percent
Milk	9 to 28
Butter	8 to 21
Tomatoes and citrus fruit	10 to 20
Leafy, green, and yellow vegetables	78 to 106

The smaller figure indicates increases which could bring grossly inadequate diets to a level of average minimum requirements but without the margin of safety afforded by the higher estimates.

Whether one group of families has a higher level of living than another depends on the yardstick used for measuring the two. Farm and urban families differ with respect to community facilities contributing to family living, with respect to occupation, form of income, and patterns of household production; their ways of spending and their standards as to desirable uses of income differ. Hence the question as to which group lives at the higher level cannot well be answered.

However, findings of this study indicate the sort of measuring stick used by farm families in deciding how income shall be allocated. Whether a person considers these decisions better or worse than those of city families will depend on his ideas of

what is most worth while in life. Farm families apparently consider it wise to use income (money and nonmoney) for broadening horizons through social contacts and news of events; expenditures for automobiles, newspapers, telephones, and radios indicate that these rank high in their scale of preferences. Adequate diets, so important for health and vitality, houses that provide ample space for living, labor-saving devices that conserve strength and provide time for community activities and recreation, also are given preferred places in the budget. Yet present wants and needs are sacrificed to future security (usually achieved through building up the farm business) to a greater extent than by a city group. The lack of community facilities makes the possession of modern housing conveniences more expensive for farm than city families; but this is not evidence of reluctance to adopt the new. Rural electrification, more good roads, and other Government programs are helping to lessen some of the difficulties of the farm families in improving their homes and keeping in touch with the world.

That many families on farms as well as in cities do not reach adequate levels of living is apparent from data concerning the lowest income groups surveyed in communities of all types. The Bureau is working with the Department in its program of giving special help to these families. With the assistance of funds from the Surplus Commodities Corporation, a small-scale study of diets of families on relief has been made in the southwest section of Washington, D. C.

Preliminary figures from this study indicate that the customary diets of the Negro families on relief in the fall and winter of 1938–39 were far below the recommended quantities of protective foods—milk, butter, eggs, tomatoes and citrus fruit, and leafy, green, and yellow vegetables. Averages for small groups of families matched in income and family composition indicate that those receiving surplus foods had more adequate diets than those depending solely on their own resources for food. The consumption of grain products by those receiving surplus foods was 7 percent higher; of butter, 67 percent; and of leafy, green, and yellow vegetables, 24 percent. Consumption of milk in its various forms was almost twice as high, and of dried fruits, about twice. These challenging facts emphasize the need for increased purchasing power on the part of a large proportion of our population, and for more widespread knowledge regarding the kind of food selection that will give excellent returns in nutritive value for food expenditures.

FOODS AND NUTRITION

The Foods and Nutrition Division has directed its researches toward (1) making more definite our information on the kinds and amounts of essential nutrients required to maintain and promote maximum health and well-being, (2) collection and interpretation of data on food composition to make possible the translation of these requirements into terms of everyday diets, and (3) studies of utilization and influence of methods of production and processing on quality of food.

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Nutrition is a dynamic science. The identification of the various food factors essential for good nutrition is still incomplete. Investigations of the nature of these factors have led to studies of the significance and quantitive occurrence of trace elements and new vitamins which are consistently present in natural food materials.

NUTRITIVE VALUES AND REQUIREMENTS

A cooperative study with the United States Public Health Service on the physiological effects of continued ingestion of small amounts of vanadium, one of the less common minerals, was reported last year. Further investigations are being made on the distribution of vanadium in different foods and in animal tissues.

Modern methods of processing foods to obtain the keeping qualities essential for distribution do change the food value. For example, the outer layers of many of our ordinary cereal grains are commonly separated in the processing of the cereals for human consumption. Investigations of rice polishings have shown that this portion of the natural rice grain contains valuable nutrients including several newly recognized vitamins. Studies are under way to determine the nutritional significance of these new vitamins, their distribution in other foods, and forms in which they may be introduced into the diet.

A reliable procedure for determining the vitamin A requirements of normal adults having been previously developed, efforts toward defining these requirements in terms of International Units and common food items have been extended. The vitamin A values of plant foods are derived from one or more of four orange-yellow pigments known as vitamin A-active carotenoids, three of which are carotenes. These pigments can be converted into vitamin A in the human body. The vitamin A value of some animal foods is due solely to vitamin A itself and that of other foods such as milk, cream, butter, cheese, and eggs to a mixture of vitamin A and the vitamin A-active carotenoids. Average American diets derive about 60 to 70 percent of their vitamin A value from the vitamin A-active carotenoids and 30 to 40 percent from vitamin A itself. In low-cost diets an even larger proportion of the total vitamin A supply is provided in the form of these important orange-yellow pigments.

The vitamin A requirements as actually determined for a group of adult volunteer subjects were measured in terms of vitamin A, crystalline vitamin A-active carotenoids, and vitamin A-active carotenoids as they occur in spinach and fresh green peas. Taking into account the fact that diets normally derive a part of their vitamin A value from foods of animal source and a part from foods of plant source, it was shown that 3,500 to 4,000 International Units daily was the average minimum requirement. This amount of vitamin A provided daily from the combination of sources just mentioned is sufficient to prevent nutritional night blindness in an adult weighing about 150 pounds. It is recommended, however, that the daily diets of adults carry at least 5,000 to 6,000 units in order to provide a reasonable margin of safety.

Natural foods always contain mixtures of essential nutrients such as protein, minerals, and vitamins. Some of these nutrients are required by the human body in very substantial amounts; others in

very small amounts. Intelligent planning of dietaries, whether for an individual, a family, or an institutional group of people requires not only knowledge of quantitative needs for good nutrition but data on the composition of foods. As such knowledge is, at present, very incomplete even for the well-known nutrients, certain food-composition studies are in progress.

Paralleling the studies of vitamin A requirements, a program of analysis of the vitamin A values of a wide variety of American foods in terms of International Units was begun. When these analyses are completed it will be possible to state the approximate vitamin A requirements in terms of average servings of numerous combinations of our ordinary foods.

A publication summarizing the data obtained in the laboratories of this Bureau on the vitamin B_1 content of about 100 food items produced in this country is now in press.

Data on the proximate composition of foods, obtained from a variety of published and unpublished sources, have also been evaluated, summarized, and prepared for publication. This compilation containing data on over 1,100 food items is now in press.

The data given in these two new publications represent, for the most part, average values for the composition of the foods listed. As such, they are specifically intended for the planning of adequate diets for individuals and groups of individuals and for use in calculating the degree of adequacy of diets of different population groups following the collection of suitable data from dietary surveys.

VITAMIN LOSSES IN COOKING

It is important to know the composition of foods, not only as they are produced, but also as they are affected by different methods of food preparation, preservation, and storage. Of all the known food essentials, vitamins B_1 and C seem most likely to be destroyed as a result of ordinary methods of cooking.

A study of the vitamin B_1 losses brought about as a result of cooking various foods by approved methods has just been completed. Foods such as meats and nuts that are often prepared by roasting lose more of their vitamin B_1 value than foods cooked a shorter time or at lower temperatures. The broiling of meats is less destructive of vitamin B_1 value than roasting. The losses in vitamin B_1 value as a result of cooking may in some foods be as great as 50 or 60 percent, but in most of the common vegetables these losses need not exceed 10 or 15 percent. In order to limit such losses to 10 or 15 percent, however, it is essential to avoid overcooking and to limit cooking liquor to a quantity that can be served with the vegetable or used in some other way.

A special study is under way to determine the vitamin C losses in Irish Cobbler and Green Mountain varieties of potatoes as a result of storage and different methods of cooking. Although potatoes do not rank among the richest food sources of vitamin C, the quantities of them used in average American diets make their contribution in vitamin C value of real significance. Potatoes cooked with skins intact retain more of their vitamin C value than do tubers cooked after paring.

FOOD UTILIZATION

Important as it is to determine human requirements for the different nutrients and to investigate the amount of these nutrients present in foods, it is still necessary to study factors of production, handling, and processing that affect the table quality and palatability of well-known foods. Some of these quality factors are studied in cooperation with other bureaus in the Department; those that are concerned with the principles and methods of home preparation and preservation of food are carried on as individual Bureau projects.

In cooperation with the Agricultural Adjustment Administration, studies were made to discover increased uses for peanuts and peanut products as peanut production has increased faster than the outlet for the crop as a food. Because of their food value, peanuts can make a valuable contribution to the diet, but before they can be used extensively in the home they should be made available at the grocery store shelled and with the brown skins removed. A chemical method for removing the brown skins of peanuts was developed in our laboratories; this method, which can be easily adapted for commercial use, results in a high-quality, stable product with low weight loss and no splitting. Recipes for peanuts previously developed are available to stimulate the home use of shelled, skinned peanuts when they are put on the retail market. The use of peanut meal and peanut flour has also been tested in baked products. Peanut flour could be widely used if a product of good color and flavor, with smooth, fine texture, clean and free from foreign material (of the same high quality as one of the samples tested), could be produced on a commercial scale.

At the request of the Farm Security Administration, recipes for the use of sorgo were developed, as a surplus stock of this sirup was available in certain sections.

Studies were made to determine the influence of different methods of freezing on the quality of frozen vegetables. Both urban and rural homemakers are requesting information on the food value and methods of cooking frozen foods. The rural housewife is interested in freezing as a method of conserving fruits and vegetables for home use.

In cooperation with the Bureau of Plant Industry studies to determine the effect of environment, soil, method of planting, variety, maturity, or storage on the cooking quality of potatoes were continued. A report on specific gravity as an aid in selecting potato varieties with high cooking quality has been summarized for publication.

The extensive, long-time study of factors that affect the palatability of meat is carried on in cooperation with the Bureau of Animal Industry, the Agricultural Marketing Service, and a number of State agricultural experiment stations. In addition to measuring quality and studying palatability factors in a large number of cuts of meat representing different methods of production and processing, the effect of methods, time, and temperature of cooking on shrinkage has been studied. A report of the effect of grade, style of cutting, and method of roasting, on shrinkage and cooking time of rib roasts of beef was published.

Other studies carried on in cooperation with the Bureau of Animal Industry have to do with the effect of production factors and processing on the palatability of poultry flesh and on the cooking quality of eggs. During the year methods were developed for cooking smoked turkey, and recipes were prepared for its use. A popular leaflet on poultry cooking was issued for the homemaker, and a set of wall charts and two film strips on the same subject were prepared for extension workers and others in the teaching field.

Additional comparative tests were made to determine the value of various types of fats for different uses. A study of the shortening value of a number of commercial fats is under way, and the results to date are being summarized for publication.

In view of the need for information by the trade and the consumer on the flavor factor in bread quality, a departmental committee has developed special techniques to determine how the flavor of bread is affected by class of wheat, type of flour, and other factors. The work of several years on this study has been summarized, and recommendations for further work have been formulated.

Scientific studies of all processes of home preservation—canning, pickling, jelly making, and preserving—were continued. Special emphasis was placed on a detailed study of processing meat to attain a safe and palatable product under home canning conditions. To test the effectiveness of different processing times and temperatures, jars of meat have been inoculated with bacteria of known heat resistance and stored under different conditions for varying lengths of time. A preliminary summary of the data from this study has been made, but final analysis of the results cannot be made until additional work is done on the problem.

In addition to studying the best ways of using new foods and new ways of using familiar foods, the Bureau also develops reliable recipes scaled to diets of different cost levels. Special emphasis has been given during the year to commodities declared to be in surplus. Very inexpensive recipes and information on the food value of the surplus commodities have been released to the Federal Surplus Commodities Corporation for distribution to agencies dealing with relief recipients and to the Department's Press Service for release in cities distributing surplus foods through the food-stamp plan.

TEXTILES AND CLOTHING

The studies of the Textile and Clothing Division are planned to help the consumer in the selection, construction, and care of clothing and household textiles. Under way at present are studies of the chemical and physical properties of various textile fabrics as a basis for the development of standards for fabrics and garments; studies to determine the best quality of fiber and the best fabric construction for a particular use; investigations of factors that tend to shorten the usefulness of a fabric together with a study of methods of controlling the destructive forces; the development of an improved basis for sizing garments; and studies of garment design for definite use and age groups.

Studies of fabrics relating directly back to raw wool and cotton have been undertaken in cooperation with other agencies within the

Department, thus relating consumer requirements for agricultural fibers directly with production plans.

CONSUMER BUYING GUIDES

With new developments and keen competition in the textile and clothing fields it is important that the consumer be given as much help as possible in her textile buying problems. This, the Division of Textiles and Clothing has endeavored to do through its publications on buying guides such as those on women's cloth coats, hosiery, dresses, and men's and boys' shirts. Wherever possible these buying guides include specifications for the fabric used in the article of clothing as well as many other points on the selection and construction that will make for longer wear and greater consumer satisfaction.

To aid in judging the serviceability that might be expected from different kinds of materials used in men's and boys' business and work shirts, laboratory tests were made on 35 fabrics commonly used for this purpose. Broadcloth, chambray, madras, printed percales, denim, and covert were included. The information thus obtained has been incorporated in a popular bulletin to help the consumer judge quality when buying this article of clothing.

Specifications for cotton corduroy—the fabric used almost exclusively for boys' winter school and play clothes—were reported to the A-6 subcommittee of the American Society for Testing Materials. The proposed standards based on the laboratory analysis of various qualities of fabrics are definitely a step toward informative labeling even though they are not yet adopted.

To date there has been no information available as to what service may be expected from fabrics which families of low-income levels must buy, yet these consumers need as much if not more help than any other group in their textile-buying problems if their textile dollars are to stretch as far as they must.

At the request of the Farm Security Administration tests were made on several fabrics commonly sold in their cooperative stores. Work on this class of fabrics is to continue, and specifications will be prepared to assist in their purchase.

To encourage the better utilization of cotton for women's, girls', and children's clothing, loan exhibits are in circulation to the State extension services. These illustrate choice of suitable cotton as well as suitable construction in dresses for all occasions, slips, garments for lounging and night wear, and raincoats. The suitable use of both cotton and wool is also shown in the constantly revised exhibits of clothing for the preschool child, still so popular that they are scheduled long in advance. A new design, also calling for cotton, was worked out for the national uniform of the 4–H Club girl, and cooperation given three pattern companies in reproducing it so that it would be available all over the United States.

SUITABILITY OF FIBER TO PURPOSE

COTTON SHEETS

In order to study the effect of growth upon fiber quality as it relates to the serviceability of the finished material, two selected mill

types of American upland cotton, grown in widely separated locations, ranging from Middling to Strict Middling in grade were made into heavy muslin sheets. Three groups of sheets, two made from each type of cotton alone and one from a mixture of the two cottons, were placed in a local hotel and subjected to regular use.

Judging from the length of service obtained from sheets in this study as compared with that obtained from mediumweight sheets made from cotton of Good Middling, Middling, and Strict Good Ordinary grades in an earlier study, it appears that the sheeting construction as well as the grade of cotton directly affects the wear that sheets will give. The heavier sheets were more closely woven, had a thread count of 68 by 72 as compared with 64 by 64 in the lighter, and had a heavier filling yarn. Several of the heavy muslin sheets in this study, made from Middling cotton, lasted through 350 washings, whereas mediumweight muslin sheets in the previous study made from the same grade of cotton lasted through only 250 washings. These studies further showed that the grade of staple and sheeting construction were more important than differences in growth conditions of the cottons used as all three groups of sheets made from the mill types of cotton withstood practically the same number of launderings.

By taking advantage of these results the manufacturer should be able, with little or no extra cost, to produce a sheet that will give longer wear and greater satisfaction to the consumer.

WOOL SUITING

Little definite information is available as to the influence of substitutions of reworked wool and rayon for new wool in suitings. A study to supply factual data on this problem has been started.

The new wool used in the project was produced on experimental animals at the Agricultural Research Center at Beltsville, Md., and was supplied through the cooperation of the Bureau of Animal Industry. It was manufactured according to a standard mill procedure into a 14-ounce suiting of a herringbone pattern. Part of the fabric was then picked apart to make the reworked and stripped reworked wool used in combination with the new wool. Six combinations of these three types of wool were used.

Some of the new wool was combined with a viscose staple rayon of a fineness comparable to that of the wool and of a length suitable for spinning by the woolen system. Spun rayon was introduced because it is an active substitute for wool and at the time the project was started as much as 40 percent of rayon was being blended with wool for men's suitings. The qualities of the fabrics are being measured. The experimental suitings were made into boys' knickers and placed in service in a local institution. Samples are withdrawn periodically for testing in order to determine what changes wear produces in the physical and chemical properties. The study is still in progress and the data obtained have not as yet been tabulated.

COTTON HOSIERY

The use of cotton in women's hosiery has declined tremendously during the last 20 years. In 1919 about 72 percent of all women's

hose was made entirely of cotton, whereas in 1937 less than 5 percent was of cotton.

Today silk is cotton's biggest competitor in the women's hosiery field. As late as 1925 the proportion between women's silk hose and all other kinds was negligible, but in 1937 about 86 percent of total production of women's hosiery was made from silk. Prior to 1929 cotton was used extensively for tops, heels, and toes in the silk hose because it wore better and permitted the hose to be sold more cheaply. Since then improvements in silk hose have increased their wearing qualities and have also decreased the amount of cotton used in the reinforcements.

The cotton hose on the market in July 1938 were in large part poorly shaped and styled, made from too-coarse yarns, and badly dyed and finished. In many cases they wore no better than silk. During the past year considerable progress has been made in the Bureau of Home Economics in the development of women's cotton hose that will wear well and at the same time meet the requirements as to appearance. Several constructions of cotton hose using upland cotton were knitted and tested in the laboratory. The most desirable properties, as shown from the tests of the resulting hose, were incorporated in a second lot in which a finer gauge as well as finer yarns were used.

Although plans are under way to spin yarns from known cotton so far only commercial, combed, mercerized, and gassed yarns have been used; however, the size of yarns has been varied. It is interesting to note that the experimental hose have all been knitted on machines normally used for silk, and that the cotton hose have the modern improvements found in the finest silk hose. They are all full-fashioned, some have the latest-type stretch tops, mesh designs, and the last ones made up were knitted on a single-head, single-unit type of machine which has only recently been introduced for silk hose. These hose are 57 gauge (the number of needles or stitches to 1½ inches), the finest gauge cotton hose known to be made.

Only the longer-staple cotton is suitable for spinning the fine yarns used in the hosiery knitted for this study. Although the quantity of this type of staple at present available is more or less limited, if cotton hose from this cotton can be shown to compete, land now utilized for growing short-staple cotton can be diverted to the production of a long-staple fiber with profit to the producer. The type of fiber for the construction of hose that best satisfies the consumer's market preferences is definitely related to the planning phase of cotton production.

Aside from attempts to improve cotton hose through construction and the type of cotton used, various finishing treatments have been applied to improve the elastic properties, water repellency, and snag resistance of the cotton stocking. Of the many treatments tried in the laboratory, octadecyl oxymethyl pyridinium chloride, a chemical that reacts with the cellulose in the cotton, produced the greatest improvement in elasticity and water repellency. After 10 launderings, each much more severe than ordinarily given hose in the home, the treated hose had a 50-percent greater distensibility than the untreated, and there was no appreciable loss in recoverability (the ability of the stocking to retain its shape after repeated distensions).

These treated stockings absorbed much less water than the untreated and at a much slower rate. They took up only about one-sixth to one-eighth as much water as the untreated ones. This difference in water absorption was not materially changed with 10 launderings. Such a treatment should greatly reduce the spots and stains that result from splashing muddy water on stockings during a rain. It should also make spots easier to remove because the soil will remain on the surface instead of penetrating into the fiber.

Preliminary tests indicate that the treated cotton hose snag less readily and have shorter loops pulled out than do the untreated hose. This should mean fewer runs in the stocking. The hose were about 5 percent stronger than they were before treatment, no heavier, and seemed softer and smoother to the touch than the untreated.

MICROBIOLOGICAL INVESTIGATIONS

Each year micro-organisms cause considerable loss in the usefulness of many fabrics. Some of these organisms merely discolor the cloth and thus render it unsightly; others actually attack the organic material of which the fabric is composed and reduce the breaking strength; and many both discolor and weaken the fiber.

Often considerably more damage may have occurred in a fabric than is indicated visibly. For example, in a study made in cooperation with the Bureau of Plant Industry concerning the physical and chemical changes produced under controlled conditions in bleached cotton duck by *Chaetomium globosum* (a fungus commonly occurring on outdoor fabrics used for awnings, tarpaulins, shock covers, and the like) and *Spirochaeta cytophaga* (a bacterium which readily decomposes cellulose), the fabrics appeared to be in good condition even after 15 days' exposure to the growth of the micro-organisms. But when the fabrics were tested for breaking strength it was found that the fabric inoculated with *Ch. globosum* had lost 93.1 percent of its original warpwise strength and 96.9 percent of its fillingwise strength. The material exposed to the growth of *S. cytophaga* for 15 days lost 79.1 percent of its warp strength and 77.6 of the filling strength. The only visible change that occurred in the fabric was that the cotton duck inoculated with *Ch. globosum* turned from white to a yellowish white, while that exposed to the growth of *S. cytophaga* became a light tan.

Also it was found that *Ch. globosum* produced greater changes in the weight, thickness, fluidity value, copper-number value, methylene blue absorption, moisture content, and ash content of the fabric and in the staple length of the fibers of the material than did *S. cytophaga*. The difference in the extent and the rapidity of deterioration produced in the cotton duck subjected to these two micro-organisms was probably closely related to their rate of growth. Such marked changes in the fabric might not occur so quickly under natural conditions since the experiment provided a more or less optimum environment. In a study of the mathematical relationships of the data, it was found that so many changes in properties are expressed by similar equations that it seems probable that these changes are interrelated.

SIZES FOR CHILDREN'S GARMENTS AND PATTERNS

That age alone is a most unreliable indicator of a child's size is clearly demonstrated by the results obtained from the study recently completed by the Textiles and Clothing Division with the cooperation of the Work Projects Administration and 19 State colleges and other educational institutions. This study included body measurements of children between the ages of 4 and 17 years. The data showed that a new system of sizing children's garments and patterns is needed and that a combination of a length and a circumference, or girth, affords a satisfactory indication of size.

From the standpoint both of statistical soundness and practicability, the Bureau of Home Economics, is, therefore, recommending a system of sizes based on a combination of height and girth of hips. This system has been presented to representatives of national organizations of manufacturers and distributors of children's wear, at conferences held under the sponsorship of the American Standards Association (an organization interested in uniformity of specifications for various commodities). These representatives in turn are discussing with their respective organizations the proposed system for sizing children's garments, looking forward to its adoption as a standard of the American Standards Association. Such a standard would be for making the models and manikins used in the sizing of ready-made garments and patterns.

The standard proposed consists of 39 sizes in all for boys—13 regulars, 13 sizes below the regulars, and 13 above; for girls, a total of 36 sizes—12 regulars, 12 below, and 12 above the regular sizes. The sizes are based upon intervals arranged on a height-girth of hips distribution table so as to include the majority of children. The standard proposed represents 89 percent of the boys measured and 86 percent of the girls. Other size intervals have been set up which will be helpful to manufacturers having a demand for garments for children whose body measurements vary greatly from the majority.

The adoption of this standard will lower alteration costs both for the consumer and retailer; will lessen the loss of good will which many retailers suffer because of badly fitted garments; and should tend to reduce "skimp cutting" which some unscrupulous manufacturers have practiced in order to undersell competitors.

HOUSING AND EQUIPMENT

The widespread interest in improving rural living conditions makes particularly timely two publications issued during the year. One, the Farm Housing Survey, giving a picture of the present situation as to size, need of repair, and facilities of farm dwellings, was based on facts collected in 1934 from more than a half million houses in 308 counties in 46 States. Information from several large-scale inquiries was utilized in the other publication, a summary of what farm families say they want and need in house design to make their homes comfortable and convenient.

Any means of easing the burden of household production is of interest to the farm homemaker, since she spends much of her time in the performance of such tasks. The various types of work carried on in the several work centers of the kitchen have been studied and

suggestions made for arrangements of equipment, work surfaces, and storage spaces that can add to efficiency. Not only is it important to make the best use of whatever space a kitchen affords, but the high costs of building make it essential to know something of the comparative value of different materials for work surfaces, floors, and walls from the standpoint of durability and satisfactory uses.

In addition, information is needed as to the minimum space requirements for effective arrangement of the needed equipment, work surfaces, and storage spaces. In cooperation with the United States Housing Authority these problems are being worked out as they affect kitchens in designs for low-cost city houses. Five floor plans have been prepared for kitchens in housing units of one, two, or three bedrooms, and three kitchens have been set up as a practical demonstration for the various housing agencies to show the workability of the plans and to illustrate not only minimum space requirements, but different arrangements of equipment. As a basis for determining minimum space allotments for farm kitchens of families of low income, a schedule listing equipment owned has been prepared, and it is hoped that surveys can be made by agents of the Farm Security Administration using this schedule.

The trend toward widespread extension of electricity to rural communities is bringing new housing and equipment problems to farm families. For example, the initial wiring of the house and other buildings for light and power should be done with consideration of possible future needs as well as immediate installations. To aid in making such decisions a bulletin on electric lighting for the farmstead has been prepared in cooperation with the Bureau of Agricultural Chemistry and Engineering, and the committee on rural lighting of the Illuminating Engineering Society. Artificial lighting makes it possible to postpone some activities until nightfall. But adequate lighting is of prime importance in conserving eyesight when close-vision tasks or reading are done after daylight is gone; it is an aid to cleanliness; and it helps to prevent accidents.

Families should consider, in making plans for acquiring household equipment, not only the initial expense and unbiased information on the cost of operation and upkeep, but also the comparative utility of different types of equipment. Contributing to answers on some of these questions, a popular bulletin on the selection, operation, and care of home refrigerators is being prepared.

Some study has also been made of electric roasters, inasmuch as many farm families are interested in this piece of equipment as a partial substitute for an electric range. Although still incomplete, this preliminary study indicates that attention should be given in selecting a roaster to its size and shape in relation to the size of utensils required for preparing the family's food. From model to model there are variations in size or shape that might at first glance appear unimportant but that can greatly influence the amount of food that can be prepared at one time. Once the techniques are mastered, satisfactory baked and roasted products and certain types of oven meals can be prepared. Electric roasters make no provision for surface-cooking operations and need to be supplemented by table stoves. Because of differences in construction some are more expensive to operate than others. There may be little correlation between the

watt rating of the roaster and its speed of heating. Some require twice as long to heat as others and twice as much energy to preheat and to maintain constant temperatures.

In cooperation with the Extension Service rural-electrification schools for home demonstration agents have been conducted to enable the agents to assist farm families when electricity is brought into a community, to wire houses adequately, to select equipment which is within their budget and will meet their individual needs, and to use and care for equipment efficiently. Another conference with representatives from six State experiment stations working in the field of household equipment was held for the purpose of continuing the standardization of tests, both technical and practical, for household equipment.

PUBLICATIONS AND INFORMATION SERVICES

The information services, like the research projects, reflect the ever-increasing demand of American citizens for scientific facts on which to base better planning and management of family living. So in addition to the technical reports giving the complete record of scientific methods and results, popular material is prepared in line with modern trends in illustration and typography. In all 23 new bulletins were printed or sent to press during the year, and numerous articles prepared at the request of scientific journals and trade papers.

DEPARTMENT PUBLICATIONS

Housing requirements of farm families in different regions of the United States. By M. Wilson. Misc. Pub. 322.

The farm-housing survey. (In cooperation with Bureau of Agricultural Engineering, Extension Service, and Office of the Secretary.) Misc. Pub. 323.

Factors to be considered in preparing minimum-wage budgets for women. By G. S. Weiss, M. Waite, and L. Stitt; with section on Retail Pricing of a Budget for a Minimum Wage, by Stella Stewart, U. S. Bureau of Labor Statistics. Misc. Pub. 324.

Outlook for farm family living in 1939. (In cooperation with Bureau of Agricultural Economics). Misc. Pub. 332.

Consumer purchases study: Family income and expenditures, Pacific region. Part one, Family income. Urban and village series. By D. Monroe, M. S. Weber and H. Hollingsworth. Misc. Pub. 339.

Hosiery for women: A buying guide. By M. Smith. Misc. Pub. 342.

Consumer purchases study: Family income and expenditures, Plains and Mountain region. Part one, Family income. Urban and village series. By G. S. Weiss, D. Monroe, and K. Cronister. Misc. Pub. 345.

Consumer purchases study: Family income and expenditures, Pacific region and Plains and Mountain region. Part one, Family income. Farm series. By D. Monroe, D. S. Martin, M. Perry, and K. Cronister. Misc. Pub. 356. (In press.)

Children's body measurements for sizing garments and patterns. By R. O'Brien and M. A. Girshick. Misc. Pub. 365.

Consumer purchases study: Family income and expenditures, Middle Atlantic and North Central region and New England region. Part one, Family income. Urban and village series. By D. Monroe, E. Phelps, D. S. Brady, and I. G. Swisher. Misc. Pub. 370. (In press.)

Diets of families of employed wage earners and clerical workers in cities. By H. K. Stiebeling and E. F. Phipard. Cir. 507.

Proximate composition of American food materials. By C. Chatfield and G. Adams. Cir. 549. (In press.)

Manufacturing and serviceability tests on sheetings made from two selected

mill types of cotton. By R. E. Rogers, M. B. Hays, and I. T. Wigington. (In cooperation with Bureau of Agricultural Economics.) Tech. Bull. 645.

Breaking strength, elongation, and folding endurance of films of starches and gelatin used in textile sizing. By M. S. Furry. Tech. Bull. 674.

Shrinkage and cooking time of rib roasts of beef of different grades as influenced by style of cutting and method of roasting. By L. M. Alexander and N. G. Clark. Tech. Bull. 676.

The vitamin B_1 content of foods in terms of crystalline thiamin. By L. E. Booher and E. R. Hartzler. Tech. Bull. 707. (In press.)

Judging fabric quality. By B. V. Morrison. Farmers' Bull. 1831. (In press.)

Housecleaning management and methods. By C. W. Moffett. Farmers' Bull. 1834. (In press.)

Cotton shirts for men and boys. By M. Smith. Farmers' Bull. 1837. (In press.)

Soybeans for the table. By E. F. Whiteman and E. K. Keyt. Leaf. 166.

Poultry cooking. Unnumbered pub.

Well-nourished children. Children's Bureau Folder 14. (In cooperation with Children's Bureau, U. S. Department of Labor.)

Poultry cooking charts. Set of 8 charts.

ARTICLES IN OUTSIDE JOURNALS

A study of the waste in preparation and in cooking of fresh vegetables and the fuel consumed. By E. F. Whiteman and F. B. King. Amer. Dietet. Assoc. Jour. 14: 615–622. Oct. 1938.

A study of the biophotometer as a means of measuring the vitamin A status of human adults. By L. E. Booher and D. E. Williams. Jour. Nutr. 16: 343–354. Oct. 1938.

New shrinkage rules for woven cotton goods. By G. R. White. Jour. Home Econ. 30: 636–638. Nov. 1938.

A realistic approach to teaching clothing expenditures. By D. Brady. Jour. Home Econ. 30: 612–616, illus. Nov. 1938.

Human conservation and nutrition. By H. K. Stiebeling. Plan Age 4 (10): 279–291. Dec. 1938.

Ascorbic acid content of commercially canned tomatoes and tomato juice. By O. E. McElroy and H. E. Munsell. Amer. Med. Assoc. Jour. 111: 2138–2139. Dec. 3, 1938.

Trade practice rules for the silk industry. By M. S. Furry. Jour. Home Econ. 31: 34–36. Jan. 1939.

Suggested consumer specifications for six classes of household blankets. By M. B. Hays. Rayon Textile Monthly 20 (2): 71–73, illus. Feb. 1939.

Family outlay for hospital care. By M. C. Klem. Mod. Hosp. 52 (2): 45–47, 51. Feb. 1939.

What we learn from serviceability studies. By M. B. Hays. Jour. Home Econ. 31: 170–172. Mar. 1939.

An experimental determination of the minimum vitamin A requirements of normal adults. By L. E. Booher, E. C. Callison, and E. M. Hewston. Jour. Nutr. 17: 317–331, illus. Apr. 1939.

Consumers have keen ears. By R. Van Deman. Retailing 11 (16, sect. 1): 15. Apr. 17, 1939.

What's in a fabric name? By L. Stanley. Retailing 11 (16, sect. 1): 13, 21. Apr. 17, 1939.

Ascorbic acid content of tomatoes as affected by home canning and subsequent storage, and of tomato juice and fresh orange juice as affected by refrigeration. By O. E. McElroy, H. E. Munsell, and M. C. Stienbarger. Jour. Home Econ. 31: 325–330. May 1939.

Family expenditures for medical and dental care. By M. C. Klem. Amer. Dent. Assoc. Jour. 26: 828–840. May 1939.

Specifications for blankets. By D. A. Taylor. Jour. Home Econ. 31: 382–383. June 1939.

A scientific basis for standard sizes for children's garments and patterns. By M. A. Girshick. Amer. Statis. Assoc. Jour. 34: 362–364. June 1939.

Uncle Sam tries his hand at hosiery designing. By D. A. Taylor and D. H. Young. Underwear and Hosiery Rev. 22 (7): 32–33, illus. July 1939.

Consumer classification and specifications for cotton broadcloth. By G. White and M. B. Hays. Amer. Dyestuff Reptr. 28: 410, 431–436, 439, illus. Aug. 7, 1939.

Consumer specifications for textiles. By M. B. Hays. Jour. Home Econ. 31: 444–446. Sept. 1939.

In addition, the following articles were contributed to the 1939 Yearbook of Agriculture:

From tradition to science. By L. Stanley.

Food functions and the relation of food to health. By L. E. Booher and C. M. Coons.

Food habits, old and new. By H. K. Stiebeling.

Vitamin needs of man. By L. E. Booher, E. C. Callison, O. L. Kline, S. L. Smith, F. W. Irish, and E. M. Nelson. (In cooperation with the Office of Experiment Stations and the Food and Drug Administration.)

Food composition. By C. Chatfield and G. Adams.

Vitamin content of foods. By E. P. Daniel.

Present-day diets in the United States. By H. K. Stiebeling and C. M. Coons.

Planning for good nutrition. By H. K. Stiebeling and F. Clark.

Better nutrition as a national goal. By H. K. Stiebeling, M. Marioletti, F. V. Waugh, and J. P. Cavin. (In cooperation with the Agricultural Adjustment Administration and the Bureau of Agricultural Economics.)

Much of the material prepared for press, radio, and exhibit use shows the close cooperation of the Bureau of Home Economics with other branches of the Department dealing with production and marketing. For instance, at the request of the Federal Surplus Commodities Corporation, radio broadcasts are given and news releases sent to the press calling attention to the nutritive values and ways of using the foods officially declared in surplus. Consumers are thus better able to take advantage of food bargains to plan balanced meals, and crop distribution is facilitated.

Outstanding also as information equally helpful to producer and consumer was the exhibit on poultry cooking prepared for the World's Poultry Congress held in Cleveland, Ohio, July 28 to August 10, 1939. A series of photomurals, film strips, and wax models showed the modern theory of cookery applied to all types of domestic poultry. To reach an even wider audience and be available for continuous use in schools and extension groups, a series of eight Poultry Cooking Charts (each 20 by 30 inches in size) were printed and placed on sale by the Superintendent of Documents. And for those who wish pictorial material in still another form, two film strips on poultry cooking were prepared in cooperation with the Extension Service.

Other exhibits include the display of publications at the annual meetings of the American Home Economics Association and the American Library Association; a booth depicting the research on vitamin A requirements of adults, arranged for the convention of the American Medical Association; and panels of new bulletins and illustrative material circulated to 45 State and regional conferences of home economics workers. Material was also furnished for Federal exhibits at both the New York World's Fair and the San Francisco Golden Gate Exposition.

U. S. GOVERNMENT PRINTING OFFICE: 1939

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REPORT OF THE DIRECTOR OF INFORMATION, 1939

United States Department of Agriculture,
Office of Information,
Washington, D. C., September 15, 1939.

Hon. Henry A. Wallace,
Secretary of Agriculture.

Dear Mr. Secretary: I submit herewith a report of the work of the Office of Information for the fiscal year ended June 30, 1939.

Sincerely yours,

M. S. Eisenhower,
Director of Information.

Early in the fiscal year 1939 the Secretary of Agriculture directed that major improvements be made in the structure and administrative functioning of the Department in order to expedite its services to the public. One purpose of reorganization was to establish within the Department a central planning agency to work with the bureaus and local planning groups of farmers in devising, within the framework of the acts of the Congress, programs better adapted to local needs. A second purpose was to group the administration of programs assigned to the Department so that they might move toward common goals with a minimum of friction. A third was to strengthen the staff agencies which help the bureaus of the Department coordinate their lines of work. As one of these staff agencies, the Office of Information was directed to place itself in a position (1) to coordinate and synthesize information originating in all branches of the Department, and (2) to render greater services to farmers and the public generally.

Accordingly, the personnel of the Office was increased somewhat. Several editorial workers were transferred from the action agencies to the Office, and three additional editorial workers were employed to round out the staff of a new Division of Special Reports. This Division prepares special informational documents reporting or interpreting the total work carried on by the several bureaus—material that could not be prepared by any one of the bureaus alone. Additional technical and clerical personnel enabled the Office to carry on an enlarged volume of services for the bureaus in the way of printing procurement, duplicating, distribution, and photographic and drafting work.

INFORMING DEPARTMENT PERSONNEL

One important new phase of informational work is the development of methods of informing the personnel of each bureau of the

activities of all bureaus and of the unifying objectives of the Department; this is essential in order that each of the programs may daily play its key part in attaining these objectives. The first step to this end was to initiate weekly conferences of information officers of the bureaus. The bureau representatives inform each other of purposes, provisions and progress of programs, so that in issuing public information each bureau is able to point out the relationship between the programs it administers and the programs administered by other bureaus. Other action now under way includes consultation with people of the Office of Personnel and of the bureaus on methods of informing all employees concerning the purposes and organization of Department work, participation in orientation meetings for new employees in Washington, and preparation of materials for future use in such meetings both in Washington and in the field.

A second important new phase of information work is the preparation and distribution of many types of informational materials needed by the farmers, technicians, and administrators who are planning agricultural programs. The democratic process of hammering out the plans through discussion, composition of differences of opinion and interest, and formulation of mutually acceptable conclusions can succeed only when the persons who take part are informed of all phases of their problems, and know the public aids that are available.

INFORMING PLANNING GROUPS

For a number of years Department agencies have been gathering much basic information concerning the fundamental thing with which planning deals—the land and the relationship between land and people. Year by year, as noted in my previous reports, the volume of information issued has grown in pace with the volume of material gathered. The fiscal year 1939 saw the increase that would be expected in the issuance through publications, by press, and by radio of a type of information that is indispensable to an orderly transition from an exploitative to a conservation type of agriculture. Among the publications issued during the year to carry information of this sort to planners—and to the interested general public—were a definitive exposition of the problem of preventing erosion, To Hold This Soil, the first item in an extensive series of surveys of erosion and land use conditions which eventually, watershed by watershed, will report for the whole country basic data on the capabilities of land for various uses; technical and popular publications giving detailed analyses of the land problems of the southern Great Plains, and the land-utilization programs for the northern Great Plains; a bibliography on soil erosion and soil and water conservation; a popular publication on crops that deplete, crops that conserve, and crops that build soil. Besides the increase in publications needed for the information of planning groups and the public generally, there was also a considerable growth in the issuance of such material to the press and through radio. Especially noteworthy was the series of 22 talks and interviews broadcast in the National Farm and Home Hour by the editor of the 1938 Yearbook of Agriculture. These talks summarized for listeners the principal facts on land utilization in the United States presented in that volume.

Besides issuing an increased volume of basic information the Department devised more effective ways of describing the purposes and provisions of the available Federal aids. Publications issued for this purpose include Planning for a Permanent Agriculture, which described between one set of covers all the action programs and suggested how these programs can be used by cooperating citizens to solve the problems of land use as they exist in any part of the country; and booklets explaining the provisions of the water-facilities program and of the flood-control program—two programs recently authorized by Congress and just getting under way in 1939.

INFORMING COOPERATORS

To inform members of planning groups on the possibilities of State action in the fields of taxation, zoning, etc., as well as to give facts about Federal aids, the Department planning agency, the Bureau of Agricultural Economics, cooperating with State agencies and action bureaus, inaugurated a new series of leaflets. The A. A. A. greatly enhanced the effectiveness of duplicated and printed materials issued from Washington to the State A. A. A. committees and transmitted by these State committees to farmers in community and county committees who carry on the work locally of administering the adjustment, conservation, crop insurance, and other programs. The experience of 6 years in working out the national programs of conservation, land use, crop adjustment, stabilization of supplies for consumers, and support for farmers' income has taught the information staff and the administrators how to provide the considerable amount of information required in conducting the programs in forms that will carry the necessary facts and interpretations and yet consume as little as possible of the time of the 95,000 farmer committeemen whose work determines the success or failure of the programs.

To inform farmers of the unifying objectives of the whole group of governmental efforts is just as important as to inform employees of the Department itself on these points. Visual materials bring these objectives home vividly. During the year the A. A. A., with assistance from the Office of Information, issued a sound-slide film, Pioneering a Permanent Country, for the use of the community and county committees of farmers. The A. A. A. had in preparation a motion picture presenting the objectives of the total Federal program with respect to conservation of soil and water. This Office cooperated with the Extension Service in planning the subject matter for an exhibit, Deep Roots for American Agriculture, portraying the unifying objectives of the national agricultural program, to be shown at meetings of farm organizations.

ECONOMIC INFORMATION

As in every other year throughout the past two decades, public demand for economic information grew steadily. Information gathered by the Department of Agriculture's representatives in this country and abroad, often being interpreted by its analytical staff of economists, was issued by methods noted in my previous reports. A new trend in economic reporting and interpretation is analysis of the marketing and distribution systems in various localities, and

the issuance of reports pointing out bottlenecks which obstruct the free flow of farm products, and analyzing alternative methods of eliminating the bottlenecks. Outstanding among such reports for the present year was Barriers to Internal Trade in Farm Products.

CONSUMER INFORMATION

With accelerating speed the nutrition scientists have gathered a mass of new knowledge which, applied, can greatly better human and animal health. The outstanding scientific publication of the year by this Department was the 1939 Yearbook of Agriculture, Food and Life, summing up modern knowledge concerning nutrition of men and nutrition of animals. The Yearbook serves as the source document for a wider program of reporting through press and radio on this important fundamental topic. Bringing the problem of correct nutrition to more immediately practical focus, the surplus removal and diversion activities of the Department were altered during the year by inauguration of the food stamp order plan. The purpose of this plan fundamentally is to bring about a wider distribution of the health-giving surplus foods among the low-income groups of the population. One of the benefits envisaged to farm and national economic welfare is the stimulation of consumption among all income groups of the surpluses of health-giving foods, particularly of fruits and vegetables, dairy, poultry, and meat products. The information services of the Department helped to speed up such consumption. The home economics releases to the press, particularly after the designation of surplus products that could be bought with the blue food order stamps, carried facts about the nutritive values of the foods that were in surplus, and about methods of making the foods into appetizing dishes. Similar information was issued by radio in the National Farm and Home Hour each week, and in the syndicate services to individual radio stations.

EXPENDITURES

Printing and binding expenditures for the fiscal year 1939 totaled $1,089,970. This included $360,618 for administrative forms and binding; $239,393 for reports, regulatory notices, periodicals, and other administrative publications; $200,340 for technical publications; and $289,619 for popular publications. Expenditures for salaries and expenses were $379,383, of which $81,665 was for the maintenance of a duplicating plant.

Funds were allotted to the Office of Information during the fiscal year to provide for additional work on behalf of the agencies. A total of $28,093 was expended for this purpose, $10,680 from conservation and use of agricultural land resources, $7,130 from land utilization and retirement of submarginal land, $5,283 from emergency relief, agriculture, and $5,000 from flood control appropriations.

DIVISION OF PUBLICATIONS

The list of new publications issued during the year gives an indication of the scope, varied character, and importance of the Department's publication program. The most important single publication

issued by the Department and reported to be the largest publication job done each year at the Government Printing Office, is the Yearbook of Agriculture. The issue for 1939 carries the subtitle "Food and Life," and is an extensive up-to-date treatment of the dual subjects, nutrition of man and nutrition of animals. This should serve as a useful reference work on these subjects for many years.

As previously noted, the public year by year demands more information on conservation of natural resources, and on economic situations affecting the welfare of citizens. Among the publications newly issued this year to provide such information were a group of special significance, including Planning for a Permanent Agriculture, Barriers to Internal Trade in Farm Products, several reports on Erosion and Land Use Conditions on various areas, The Land Utilization Program for the Northern Great Plains, Problem-Area Groups of Land in the Southern Great Plains, An Outline of the Water Facilities Program, Family Income and Expenditures, Outlook for Farm Family Living, The Land in Flood Control, To Hold this Soil, Bibliography on Soil Erosion and Soil and Water Conservation, Soil-Depleting, Soil-Conserving, and Soil-Building Crops, and The Farm-Housing Survey.

Besides issuing these publications on the subjects which are at the heart of the problem of setting up a permanent agriculture for the United States, the Department continued its older program of publication for the use of scientists, farmers, homemakers, and others, the results of research or regulatory work, and recommendations for farming and homemaking practices.

Below are listed the 19 Farmers' Bulletins, 21 Leaflets, 41 Miscellaneous Publications, 50 Circulars, 64 Technical Bulletins, and 22 unnumbered publications newly issued during the year.

LIST OF NEW PUBLICATIONS ISSUED DURING THE FISCAL YEAR 1939

Farmers' Bulletins:

1802. Modernizing Cotton Gins.
1803. Culture and Pests of Field Peas.
1804. Community Buildings for Farm Families.
1805. Grading Wool.
1806. Hard Red Winter Wheat Varieties.
1807. Lamb and Mutton on the Farm.
1808. Rice Culture in the Southern States.
1809. Soil Defense in the South.
1810. Soil Defense in the Northeast.
1811. Control of Insects Attacking Grain in Farm Storage.
1812. Native and Adapted Grasses for Conservation of Soil and Moisture in the Great Plains and Western States.
1815. Grading Dressed Turkeys.
1816. Mechanizing the Corn Harvest.
1817. Growing Wheat in the Eastern United States.
1818. Mechanical Milk Cooling on Farms.
1819. Infectious Anemia (Swamp Fever).
1820. Silos, types and construction.
1821. Containers for Fruits and Vegetables.
1822. Seed Corn.

Leaflets:

160. Crimson Clover.
163. Legumes in Soil Conservation Practices.
164. Erosion on Roads and Adjacent Lands.
165. Soil-Depleting, Soil-Conserving, and Soil-Building Crops.

Leaflets—Continued.

166. Soybeans for the Table.
167. Facts About Cotton.
168. Dual Purpose Pines.
169. Preventing Gin Damage to Cotton.
170. Date Growing in the United States.
171. The Timothy Crop.
172. Why Fruit Trees Fail to Bear.
173. The Bud-Graft Method of Propagating Vinifera Grape Varieties on Rootstocks.
174. Bean Bacterial Wilt.
175. Eradication of the Cultivated Black Currant in White Pine Regions.
177. The Pasteurization of Milk.
178. Dwarf Fruits.
179. The Native Papaw.
180. How to Keep and Increase Black Grama on Southwestern Ranges.
181. Drying Seed Cotton.
182. Housefly Control.
183. Cankerworms.

Miscellaneous Publications:

268. A Graphic Summary of Agricultural Credit.
269. A Graphic Summary of Farm Animals and Animal Products.
292. Market Diseases of Fruits and Vegetables; Crucifers and Cucurbits.
295. Famous Trees.
303. Native Woody Plants of the United States.
305. The Horseflies of the Subfamily Tabaninae of the Neartic Region.
306. The Forest Products Laboratory.
307. Knots in Second-Growth Pine and the Desirability of Pruning.
309. Forest Resources of the North Louisiana Delta.
312. Bibliography on Soil Erosion and Soil and Water Conservation.
313. Forest Resources of Northeastern Florida.
314. Overhead Cleaner-Drying Systems for Seed Cotton.
316. Descriptions of Types of Principal American Varieties of Spinach.
317. Improving Poultry through the National Poultry Improvement Plan.
318. 4–H Club Insect Manual.
319. Plans of Farm Buildings for Western States.
320. Organization of 4–H Club Work.
321. To Hold this Soil.
322. Housing Requirements of Farm Families in the United States.
323. The Farm-Housing Survey.
324. Factors to be Considered in Preparing Minimum Wage Budgets for Women.
325. Grain Grading Primer.
326. Forest Resources of Southeastern Texas.
327. Motor Fuels from Farm Products.
328. The Service of Federal Grain Standards.
329. Officials and Organizations Concerned with Wildlife Protection, 1938.
330. The Minnesota Seed-Grain Treater.
331. The Land in Flood Control.
332. Outlook for Farm Family Living.
333. The Farm Outlook for 1939.
334. Land Facts on the Southern Plains.
335. Workers in Subjects pertaining to Agriculture in Land-Grant Colleges and Experiment Stations, 1938–39.
337. Abbreviations used in the Department of Agriculture for Titles of Publications.
339. Family Income and Expenditures.
342. Hosiery for Women—A Buying Guide.
343. Directory of Field Activities of the Bureau of Biological Survey.
346. Short-Time Camps. A Manual for 4–H Leaders.
347. Lumber Requirements for Nonfarm Residential Construction.
348. Federal Legislation, Rulings, and Regulations Affecting the State Agricultural Experiment Stations.
350. The Wildlife Restoration Program under the Pittman-Robertson Act of 1937.
351. Planning for a Permanent Agriculture.

Circulars:

471. Forests and Employment in Germany.
472. Comparative Value of Mature Sows and Gilts for Producing Market Hogs.
473. Variety Studies in Relation to Fusarium Wilt of Peas.
476. Evaluation of Sugar-Beet Types in Certain Sugar-Beet-Growing Districts in the United States.
477. Winter Wheat and Sorghum Production in the Southern Great Plains Under Limited Rainfall.
479. Agricultural Investigations at the United States Field Station Sacaton, Arizona, 1931–35.
481. Food Consumption of Children at the National Child Research Center.
482. Surface Run-off and Erosion on Granitic Mountain Soils of Idaho as Influenced by Range Cover, Soil Disturbance, Slope, and Precipitation Intensity.
483. Proposed Minimum Requirements of 3 Types of Upholstery Fabrics Based on the Analysis of 62 Materials.
484. Effect of Date of Harvest on Yield and Milling Quality of Rice.
485. Tetrastichus Brevistigma Gahan, a Pupal Parasite of the Elm Leaf Beetle.
486. Factors Affecting Establishment of Douglas Fir Seedlings.
487. Selecting Fertilizers.
488. Developments in Mechanical Equipment and Methods in Sugar-Beet Production.
489. Selection, Installation, Finish, and Maintenance of Wood Floors for Dwellings.
490. Soil Erosion in the Karst Lands of Kentucky.
491. Grass Culture and Range Improvement in the Central and Southern Great Plains.
492. Pecan Soils of the Gulf and Southeastern States and Maintenance of Their Fertility.
493. The Earlaine Potato, a New Early Variety.
494. The Texas Leaf-Cutting Ant and Its Control.
495. The Sweetpotato Leaf Beetle.
496. Time of Irrigating Potatoes as Affecting Stolon Growth and Tuber Set and Development.
497. Composition of the Rhizome, Stem, and Leaf of Some Horticultural Forms of Canna in Relation to Their Possible Use.
498. Effect of Potash on Grade, Shape, and Yield of Certain Varieties of Sweetpotatoes Grown in South Carolina.
499. A Comparative Study of Suitability for Drying Purposes in Forty Varieties of the Sweetpotato.
500. U. S. No. 5 Refugee, a New Mosaic-Resistant Refugee Bean.
501. Reaction of Wheat, Barley, and Rye Varieties to Stripe Rust in the Pacific Northwest.
502. Sweetpotato Propagation and Transplanting Studies.
503. The Sebago Potato, a New Variety Resistant to Late Blight.
504. Early Winter Food of Ruffed Grouse on the George Washington National Forest.
505. Market Classes and Grades of Feeder and Stocker Cattle.
506. Control of the Corn Earworm on Fordhook Lima Beans in Eastern Virginia.
507. Diets of Families of Employed Wage Earners and Clerical Workers in Cities.
508. The Comparative Attractiveness of Various Small Grains to the Chinch Bug.
509. Mushroom Casing Soil in Relation to Yield.
510. Air Blast Gin Performance and Maintenance.
511. Control of Black Rot of Pineapples in Transit.
512. Longevity of Onion Seed in Relation to Storage Conditions.
513. Curly-Top-Resistant Sugar-beet Varieties in 1938.
514. Differential Staining of Sections of Unpreserved Bovine Udder Tissue Affected With Mastitis.
515. Handling and Shipping Strawberries Without Refrigeration.
516. Control of Cyclamen and Broad Mites on Gerbera.
517. The Northstar Strawberry.

Circulars—Continued.

518. Breeding Areas and Economic Distribution of the Beet Leaf-Hopper in New Mexico, Southern Colorado, and Western Texas.
519. The Tobacco Industry in Puerto Rico.
520. Wildlife of the Atlantic Coast Salt Marshes.
521. Studies of Gaps in Sugarcane Rows and Their Effect Upon Yield Under Louisiana Conditions.
522. A Soft Cheese of the Bel Paese Type.
524. Determination of Slaughter-Steer Grades From Weights and Measurements.
528. New Chrysanthemums.

Technical Bulletins:

609. Chemical and Physical Properties of Certain Soils Developed From Granitic Materials in New England and the Piedmont, and of Their Colloids.
612. Symptoms on Field-Grown Tobacco Characteristics of the Deficient Supply of Each of Several Essential Chemical Elements.
615. Studies of Potato Storage Houses in Maine.
616. The Reproductive Cycle of the Coyote.
617. Conservation and Use of Soil Moisture at Mandan, N. Dak.
618. Biological Studies on the Leafhopper Empoasca fabae as a Bean Pest.
620. Genetic Relations of Some Color Factors in Lettuce.
621. Shrinkage and Dressing Yields of Hogs.
622. Removal of Lead Spray Residues From Apples Grown in the Shenandoah-Cumberland Valley.
623. Fumigation of Baled Cotton With Hydrocyanic Acid for the Pink Bollworm.
624. Studies on the Epidemiology of Curly Top in Southern Idaho, With Special Reference to Sugar Beets and Weed Hosts of the Vector Eutettix tenellus.
625. Stickiness and Spotting of Shelled Green Lima Beans.
626. Stumpage Prices of Privately Owned Timber in the United States.
627. Body Icing in Transit Refrigeration of Vegetables.
628. Effect of Supplementing Winter and Summer Range on Gains of Steers in the Northern Great Plains.
629. Communicability of Infectious Abortion between Swine and Cattle.
630. Yield of Even-Aged Stands of Ponderosa Pine.
631. The Storage of Sweet Cherries as Influenced by Carbon Dioxide and Volatile Fungicides.
632. Loss, During Storage, of Vitamin *A* from Alfalfa Leaf Meals fed to Chickens.
633. Principles of Gully Erosion in the Piedmont of South Carolina.
634. Food of Game Ducks in the United States and Canada.
635. Comparison of Alfalfa and Western Wheatgrass hays for wintering yearling Heifers in the Northern Great Plains and their Influence on Summer Gains.
636. Correlations between Annual Precipitation and the Yield of Spring Wheat in the Great Plains.
637. Subsoil Moisture under Semiarid Conditions.
638. Temperature and other Factors Affecting the Germination of Fescue Seed.
640. Growth of Lemon Fruits in Relation to Moisture Content of the Soil.
641. Red Rot of Sugarcane.
642. The Field Cricket in Relation to the Cotton Plant in Louisiana.
643. Food Habits of North American Diving Ducks.
644. The Chemical Determination of Soundness in Corn.
645. Manufacturing and Serviceability Tests on Sheetings made from Two Selected Mill Types of Cotton.
646. Marketing Commercial Cabbage.
647. Field Studies of Certain Diseases of Snap Beans in the Southeast.
649. Relative Values for Milk Production of Hay and Silage Made from Immature Pasture Herbage.
650. Control of the Blue Mold (Downy Mildew) Disease of Tobacco by Spraying.
651. Forest Fire Insurance in the Northeastern States.
652. Flow of Water in Irrigation and Similar Canals.

Technical Bulletins—Continued.

653. A Revision of the Mites of the Subfamily Tarsoneminae of North America, the West Indies and the Hawaiian Islands.
654. Changes in Weedy Plant Cover on Cleared Sagebrush Land and Their Probable Causes.
655. Dormancy in Lettuce Seed and Some Factors Influencing Its Germination.
656. Cost of Producing Extracted Honey in California.
658. Vaccination of Calves and Yearlings Against Bang's Disease.
659. The Sand Wireworm and its Control in the South Carolina Coastal Plain.
660. The Hohenheim System in the Management of Permanent Pastures for Dairy Cattle.
661. Rearing Foals and Lambs by the Use of Colostrum, Blood Serum, and Substitute Milks.
662. Cotton Sold in the Seed in the United States.
663. Effect of Cleaning Seed Cotton on Lint Quality and Ginning Efficiency.
664. Relative Merits of Producing Creep-fed, Feeder, and Lot-fattened Calves in the Appalachian Region.
665. Relationships Among Production and Grade Factors of Beef.
666. Pythium Root Rot of Sugarcane.
667. Wintering Steers on Different Planes of Nutrition from Weaning to 2½ Years of Age.
668. Bruising, Freezing, and Chemical Injury of Potatoes in Transit.
669. Fertilizer Placement for Potatoes.
670. Relation of Temperature and Moisture Content to Longevity of Chewing Fescue Seed.
671. Composition and Properties of Goat's Milk as Compared with Cow's Milk.
672. Vapor-Heat Treatment for the Control of Narcissus Bulb Pests in the Pacific Northwest.
673. The Distribution of Insects, Spiders, and Mites in the Air.
674. Breaking Strength, Elongation, and Folding Endurance of Films of Starches and Gelatin Used in Textile Sizing.
675. Sewage Irrigation as Practiced in the Western States.
676. Shrinkage and Cooking Time of Rib Roasts of Beef of Different Grades as Influenced by Style of Cutting and Method of Roasting.
677. Experiments in Breeding Holstein-Friesian Cattle for Milk and Butterfat-Producing Ability, and an Analysis of the Foundation Cows and of the First Cutbred Generation.
679. Studies on the Development of the Pigeon Capillarid, Capillaria columbae.
681. The Effect of Intensity and Frequency of Clipping on Density and Yield of Black Grama and Tobosa Grass.
682. Plantation Organization and Operation in the Yazoo-Mississippi Delta Area.

Unnumbered publications

Southeastern Idaho Land Utilization Project.
Dixon Spring Land Utilization Project.
The Bean Blossom Land Utilization Project.
The Allegan Land Utilization Project.
The Land Utilization Program for the Northern Great Plains.
Rural Zoning and Your County.
Barriers to Internal Trade in Farm Products.
Building Rural Leadership.
Handbook of Fire Control Equipment.
Sawtooth National Forest.
Dry Skim Milk.
Transition Curves for Highways.
Hands to Save the Soil.
Erosion and Related Land Use Conditions on the Froid Demonstration Project, Montana.
Erosion and Related Land Use Conditions on the Reedy Fork Demonstration Area, North Carolina.
Erosion and Related Land Use Conditions on the Minot Area, North Dakota.

Unnumbered publications—Continued.

Erosion and Related Land Use Conditions on the Elm Creek Watershed, Texas.
Erosion and Related Land Use Conditions on the Scantic River Watershed, Connecticut, Massachusetts.
Problem-Area Groups of Land in the Southern Great Plains.
Erosion and Related Land Use Conditions on the Watershed of White Rock Reservoir Near Dallas, Tex.
From Ridge to River.
An Outline of the Water Facilities Program.

OTHER PRINTED AND DUPLICATED MATERIAL

In addition to the new publications above listed, the work of the Division is concerned with two other avenues for the dissemination of agricultural information. One is publication in nongovernmental scientific, scholarly, or other periodicals. The other is the duplication of material by the mimeograph, multigraph, or multilith processes. The Division handled 2,520 articles prepared by Department workers and intended for outside delivery or publication. Exactly 44,047 copies of reprints of 297 of the articles were purchased for official use at a cost of $2,379.66. The material duplicated was of temporary or administrative nature in accordance with the practices recommended by the Interdepartmental Committee on Printing and Processing and approved by the Joint Committee on Printing, the Bureau of the Budget, and the Comptroller General, and although of great importance in the execution of the Department's extensive program of work, it was not of such character as to justify being printed. During the year 141,085,920 pages were issued, an increase of 34,587,541 pages over the number issued the preceding year.

By far the largest item in the Department's printing bill is for job work. This consists of the official administrative forms and miscellaneous material necessary for the conduct of the Department's business and the execution of its authorized projects. In addition to the new publications listed and the purchase of reprints of articles in outside periodicals the printing and binding expenditures went for job work, for reprints and revisions of Department publications previously issued, periodicals published by the Department, authorized printing done outside of Washington, binding, and miscellaneous items.

STATISTICAL DATA

During the year 21,932,430 copies of publications and 4,250,300 lists of publications were distributed. Of these, 11,693,179 were Farmers' Bulletins and Leaflets. The Superintendent of Documents sold 604,322 copies of Department publications and 18,828 full and partial subscriptions to Department periodicals, the total amounting to $80,299.65.

A total of 1,578 manuscripts of all types were received in the Division for publication in 1939, as compared with 1,505 in 1938. In the Section of Illustrations the drafting unit completed 2,726 jobs and the photographic unit turned out a total of 279,507 items including prints, negatives, plates, slides, enlargements, and photostat copies. Requisitions to the number of 7,183 were drawn on the Government Printing Office for work to be done there. In addition, 155 releases were granted for printing to be done outside of the Government Printing Office.

Table 1 gives a detailed report by series of the publications received and distributed during the year.

TABLE 1.—*Report of publications received and distributed by the Office of Information, July 1, 1938, to June 30, 1939*

Item	Copies on hand July 1, 1938	Copies of new publications received	Copies of reprints or revisions received	Total copies available for distribution	Copies distributed	Copies on hand June 30, 1939
Agricultural Situation		3,085,325	500	3,085,825	3,085,825	
Annual reports	12,253	51,890		64,143	49,441	14,702
Atlas American Agriculture	2,815			2,815	328	2,487
Circulars	475,602	237,000	134,117	846,719	336,927	509,792
Climatological Data		13,080		13,080	13,080	
Clip Sheet		301,950		301,950	301,950	
Crops and Markets		134,150		134,150	134,150	
Department bulletins	19,829		9,750	29,579	13,922	15,657
Department circulars	12,853		38,000	50,853	29,228	21,625
Experiment station bulletins and reports		9,750		9,750	9,750	
Experiment Station Record		71,775		71,775	71,775	
Extension Service Review		115,300		115,300	115,300	
Farmers' bulletins	7,107,800	650,000	11,143,000	18,900,800	9,694,100	9,206,700
Farmers' bulletins lists	1,074,350		4,145,000	5,219,350	3,969,250	1,250,100
Fire Control Notes		12,000		12,000	12,000	
Forest Service recreational folders		198,800		198,800	198,800	
Indexes	14,443	58,100	300	72,843	53,787	19,056
Inventories of seeds and plants imported		1,500		1,500	1,500	
Journal of Agricultural Research		44,625		44,625	44,625	
Agricultural research separates	800	69,750		70,550	69,800	750
Land Policy Review		36,000		36,000	36,000	
Leaflets	2,047,255	725,000	1,840,000	4,612,255	1,999,079	2,613,176
Miscellaneous circulars	39,150		16,000	55,150	24,731	30,419
Miscellaneous publications	684,450	801,500	709,000	2,194,950	1,353,261	841,689
Monthly list of publications		281,050		281,050	281,050	
Monthly Weather Review		20,400		20,400	20,400	
Monthly Weather Review separates		14,100		14,100	14,100	
North American fauna	1,574		175	1,749	846	903
Posters	261,540	279,000	139,410	679,950	370,799	309,151
Public Roads		57,400		57,400	57,400	
Service and regulatory announcements	136,518	843,525	99,500	1,079,543	950,812	128,731
Soil Conservation		71,800		71,800	71,800	
Soil surveys	127,537	64,900	5,694	198,131	35,390	162,741
Statistical bulletins	15,265	32,500		47,765	23,830	23,935
Statistics	1,146	13,000		14,146	13,469	677
Technical bulletins	199,475	219,250	64,500	483,225	245,466	237,759
Unnumbered publications	2,028,449	1,267,040	1,013,575	4,309,064	2,082,494	2,226,570
Weekly weather crop report and snow and ice bulletins		288,080		288,080	288,080	
Yearbooks	7,090	15,000		22,090	19,515	2,575
Yearbook separates	99,594	97,600	8,000	205,194	88,670	116,524
Total	14,369,788	10,182,140	19,366,521	43,918,449	26,182,730	17,735,719

PRESS SERVICE

Reorganization of the Department on October 6, 1938, brought about many changes in information work, mentioned earlier. At that time the Press Service became the clearing house for all departmental information issued to the press.

The press continued to call upon the Department for a considerable volume of information on the national farm programs, results of research work, and economic facts related to agriculture. The large metropolitan dailies asked mainly for national and regional stories reporting agricultural events or conditions and progress in national programs; the smaller dailies and weeklies sought localized stories on such topics.

In the year just closed every effort was made to supply the press with the matter most desired and needed by readers. The number

of mimeographed releases sent was only 5 more than in the previous year, in spite of the enlargement of Department activities during the year. In all, 1,959 releases were sent direct to the press last year.

The number of stories sent to State extension editors for local adaptation and distribution through the Weekly News Service was more than double the number prepared last year. This increase was to be expected, as this relatively new service developed in usefulness to the readers of the local press in various sections. It is unlikely that the number of stories in future years will exceed the 292 sent this year. Many of these stories were sent to the extension editors in only a small number of States, and it is probable that no one State editor received more than one-third of the total.

The plan of preparing stories in Washington and sending them to State extension editors for distribution within their own States has now become established for getting many types of information to farmers quickly and accurately. In the past year, 45 States cooperated in this plan of news dissemination. In addition to the 292 stories of primary interest to farmers, 110 stories of special interest to women were mailed to extension editors in the Homemaker News Service. These stories are localized and distributed in the same manner as those dealing with farm subjects. The Homemaker News Service supplies readers of the press in States which do not have a woman writer on the extension staff with useful information that they otherwise would not obtain. The news service for homemakers has been improved by the addition of a story each week on foods, based upon subjects that are seasonal at the time of issuance.

IMPROVEMENT OF MAILING LISTS

For many years it has been the practice of the Press Service to revise its mailing lists annually, dropping the names of those who do not return questionnaire cards. Another long-established policy is that names are added to mailing lists only upon request. Because of these policies it will not be difficult for the Department to comply with the new postal regulation requiring that no material be mailed under penalty privilege unless the recipient has requested it.

To keep pace with the public's growing desire for pictorial material the Press Service has greatly strengthened its photographic service to writers and editors. The photographic file has now been revised and is in use constantly by writers and editors. We have tried to make this file large enough to give a comprehensive idea of the Department's work, but not so large as to be unwieldy. Many of the photographs were culled from the collections filed in some 35 offices in different parts of the Department. Others were taken by a staff photographer in Washington and by photographers of the Farm Security Administration and the Soil Conservation Service in the field.

Cooperation of the Farm Security Administration and Soil Conservation Service enabled the Press Service to make many pictures last year at field stations of other bureaus that do not have photographers. When Farm Security Administration and Soil Conservation Service photographers, in connection with their regular duties, happened to be near a place where the Press Service wanted a set of

pictures they were detailed to get them for us. In this way, we have been able to put together several picture essays on some of the Department's research begun in Washington, continued in the field, and applied in many different places. As in the past, the Press Service met numerous requests from commercial news photographers for ideas for picture strips for use in rotogravure sections and in magazines and arranged for the taking of these pictures.

At the request of photographers representing the news services, newspapers, and news reels in Washington a mailing list was set up to receive all releases that can be illustrated to good advantage, as well as advance notices of meetings these photographers cover.

RADIO SERVICE

Broadcasting of information arising out of the services and activities of the Department of Agriculture increased noticeably this year. The number of NBC associated stations releasing the National Farm and Home Hour increased to 104 as of September 26, 1938; the number of local stations which receive the Department's Farm Flashes increased by 99 to reach a new high of 431; local stations that have requested the Homemakers' Chats total 255. Nine local stations during this year launched sustaining public service farm programs and sought participation by the Department of Agriculture and State land-grant colleges. The number of stations subscribing to the United Press Radio News Service (which carries a feature known as On the Farm Front to which the Department contributes) reached 315. At the request of Station WLW the Department contributed seven programs in The Nation's School of the Air, directed to junior high-school students and carried by the Mutual network. Arrangements were made by the Farm Security Administration with KOA, Denver, for a weekly series of broadcasts by Department of Agriculture and other Federal and State agencies covering services rendered by those agencies in the area served by KOA. This program is known as Problems of Plains and Mountains. One broadcast to South American listeners was put on the air from New York by NBC February 12, 1939, and carried by RCA communications to Argentina for release in that country by El Mundo network. The Department contributed 23 broadcasts in a series arranged by the National Emergency Council for presentation on local stations under the general title of "U. S. Government Reports." This is not a complete record of Department of Agriculture broadcasting, but it is indicative of the wide range of regular and special radio services reporting useful information from the research and action programs of the Department.

Participation in the National Farm and Home Hour continued to be a major radio activity of the Department. This program entered its eleventh year October 2, 1938. Nineteen bureaus, offices, and action agencies were represented this year. Notable broadcasts during the year were 8 addresses by the Secretary of Agriculture, 1 by the Under Secretary, and 2 by the Assistant Secretary; weekly reports by officials of the Agricultural Adjustment Administration on objectives and progress of the national farm program; 38 broadcasts by officials of the Soil Conservation Service giving information

to assist farmers in conserving soil and water; 22 broadcasts by the editor of the Yearbook of Agriculture, based on the 1938 Yearbook, Soils and Men; 30 broadcasts by officials of the Forest Service and 46 episodes of Uncle Sam's Forest Rangers—all giving information that will assist in conserving forest resources; the monthly special land-grant college, 4–H Club, and home demonstration programs. Special attention was given to information for consumers and homemakers, including 48 broadcasts reporting research by the Bureau of Home Economics and a series of 30 broadcasts reporting work of 10 different bureaus of particular service to consumers and the public at large.

For the second successive year the National Farm and Home Hour was shifted to daylight-saving time during the summer months. Effective September 26, 1938, the last 15 minutes of the National Farm and Home Hour was dropped out of the program and replaced with five regional farm news programs, three of them commercially sponsored. The Department of course in accordance with its established policy took no part in these or any other commercially sponsored programs.

A major change in the Farm Flash manuscript service for local stations became effective February 28, 1939. Previous to that date a 7-minute, 6-day-a-week script service had been provided. This was replaced with an individual news story script service, each news story scrutinized carefully as to its application and then sent immediately only to the States in which it applied. This change was accompanied by progress toward servicing all individual radio stations through the State extension editors. In March 1939, the number of States in which the editors distribute the Farm Flashes reached 43 * * * all States except Colorado, Connecticut Kentucky, Wyoming, and Vermont. In Connecticut and Vermont the Farm Flashes are incorporated in News of New England Agriculture, syndicated to several stations in each New England State by the New England Radio News Service. Therefore, the Department's Farm Flashes now pass through local hands to radio stations in all but 3 three States. These Flashes are now received by 431 stations * * * an increase of 99 over last year.

The Homemakers' Chat syndicated manuscript service was continued this year. Requests for this 6-day-a-week service have steadily increased. The Chats are now sent to 255 radio stations and to 169 individuals (mostly home demonstration agents) who use them as reference material and, in some cases, as sources of information for broadcasting. In 19 States (8 more than last year) the Chats reach the stations through the State extension editors.

The Department provided United Press Radio News with from 400 to 800 words a day of Department news and information for use in the On the Farm Front feature. As of June 1939, a total of 315 local stations subscribed to the United Press Radio News Service.

The Consumers Counsel Division of the A. A. A. cooperated with the General Federation of Women's Clubs in a weekly trans-continental consumer program over the NBC Red network.

In the far West the Department broadcast a 15-minute (Monday-Friday inclusive) regional farm and home program known as Western United States Department of Agriculture. This program is

carried by 6 stations associated with the NBC Pacific Coast Blue network. This program is presented during the noon hour (12:45 to 1:00 p. m., Pacific standard time, at present). During this year, 12 bureaus and offices of the Department and the extension services of 5 Western States participated in 240 broadcasts designed to provide far-western listeners with information applying to western agriculture and homemaking.

State extension services made marked progress in using radio as a means of providing the public with news and information arising from the research and the service work of the land-grant colleges and the Department of Agriculture. During this year 4 States (Minnesota, New Mexico, Oklahoma, and Washington) added radio specialists to their extension staffs, bringing to 21 the number of States in which 1 or more persons devote most of their time to development of radio program services. At least 10 other State extension services are providing radio listeners with farm and home information; and in the remaining 17 States a certain amount of broadcasting is done by State and county extension workers.

The Department broadcasts only in the time made available by the broadcasting stations. No transmitters are operated by the Department, and the Congress appropriates no funds for hiring transmitting facilities. So the Department seeks and accepts the cooperation of individual stations and of networks. The maintenance of cooperative relationships with these radio organizations is one of the fundamental responsibilities of the Radio Service. Not only does the Radio Service do this for the Department but it also cooperates with the State extension services in developing improved service through the individual stations and in maintaining relationships.

DIVISION OF SPECIAL REPORTS

Coordination of information service for the Department of Agriculture has included the preparation of information materials dealing with related phases of the work of the various agencies of the Department.

These materials have covered a variety of subject matter, as wide as the activities of the Department and have been used in the preparation of bulletins, in special reports, to supply information for farm journals, and to supply information for Department personnel.

The work of the Special Reports Division is concerned largely with reporting the total effort of the Department to bring services to the people of the United States. As noted earlier, there has been an increasing need for informational materials in this field.

When farmers were concerned chiefly with problems of efficiency in production and marketing, most Department bulletins reported research activities. In recent years there has been a growing demand and a growing need among farmers for information on factors affecting the markets for their products and on factors affecting their incomes and their welfare in general. Information materials are being made available on the total program of the Department in relation to these problems.

The need for methods of dealing with the newer and more difficult problems of agriculture has resulted in a large number of legislative

enactments which have greatly broadened the responsibilities and the work of the Department. Under this legislation and previous authorizations the Department is now concerned with problems of assisting farmers to bring about a stable income and balanced relationship with the rest of our economy, with problems of conservation of basic resources and greater security of tenure, and with problems of efficient production, distribution, and use of agricultural products.

With such a comprehensive program of public aids to agriculture in operation it has become clearly necessary to provide farmers of today with informational materials that will bring to them in coordinated and most highly useful form the facts about the whole range of new and old agricultural programs. This is a new informational need felt and expressed by farmers. It does not supplant the need for the informational materials originating in the older and still continuing programs of research, regulation, and service. The new types of information must be supplied in addition to the older types.

In cooperation with all the agencies of the Department, the Division of Special Reports prepares the newer types of informational materials presenting comprehensive summaries of the relationship of all the programs to the problems of farmers and the general public. The Division was staffed and its work started late in the year. Immediately undertaken was the preparation of a new publication, Achieving a Balanced Agriculture, reporting the entire program of Federal public aids to agriculture. Also started was the preparation of a series of manuals, one for each State, giving the facts about the operations of Department of Agriculture agencies in each State, and directing citizens who wished to avail themselves of Department services to the headquarters of each Department agency in the State. Planning of other series of materials needed in helping citizens use the departmental services was underway at the close of the year.

U. S. GOVERNMENT PRINTING OFFICE: 1939

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REPORT OF THE LIBRARIAN, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
LIBRARY,
Washington, D. C., September 15, 1939.

HON. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the library for the fiscal year ended June 30, 1939.[1]

Sincerely yours,

CLARIBEL R. BARNETT, *Librarian.*

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The following account of the library activities of the Department during the past year is based on the manuscript reports submitted by the heads of the divisions of the main library and the librarian of the branch libraries in the various bureaus. The four units of the main library are the Readers' Division, the Catalog Division, the Periodical Division, and the business office. A list of the branch libraries is given on pages 14–15.

ACQUISITIONS

The library has only two incunabula [2] but it has a notable collection of old and rare agricultural, scientific, and economic books of the sixteenth, seventeenth, and eighteenth centuries. Among the sixteenth century books more than 50 were published as early as the first half of the century. Fortunately, the great majority of the rare books in the library's collections were acquired 25 or more years ago, when prices were more reasonable. Because of its limited funds, few purchases of old and rare books worthy of special note have been made in the past 8 years. The only items in this class purchased during the past year were: L'Agriculture et Maison Rustique de MM. Charles Estienne et Jean Liebault. Edition dernière, Lyon, 1583; Plan der Fränkisch-Physicalisch-Öconomischen Bienen-Gesellschaft.

[1] The report for the fiscal year 1938 was issued in multigraphed form.
[2] In the Weather Bureau collection.

Herausgegeben von J. L. Eyrich. Anspach, 1768; Der Fränkischen Gesellschaft; Vernunft- und erfahrungsmässiger Entwurf zur vollkommensten Bienenpflege für alle Landesgegenden. Von J. L. Eyrich. 4th ed. Nürnberg, 1771; Traité Curieux des Mouches a Miel, Contenant la Maniere de les bien Gouverner, Pour en Tirer un Profit Considerable par la Récolte de la Cire & du Miel; Avec un Traité des Vers a Soye. Par Louis Liger. Paris, 1734.

Some unusual gifts should also be specially mentioned. One was a photostat copy of a rubbing from a Chinese stone tablet giving illustrations of cotton and cotton manufacturing in ancient China, with poems composed and written by His Imperial Majesty, the Emperor Chien Lung (1711–99). This was presented to the Department by Donald Comer through the Division of Cotton Marketing. One of the illustrations is a picture of a ginning machine used many years before Eli Whitney invented his machine. The other publication was a manuscript volume of the Proceedings of the Matamek Conference on Biological Cycles, Labrador, 1931, presented by Copley Amory, chairman of the permanent committee, and is one of five copies.

As in previous years, about three-fourths of the library's accessions were received as gifts and exchanges. The publications received in this way are for the most part not in the regular book trade. To obtain them, therefore, the library must depend on the cooperation of the institutions, societies, firms, and "friends of the library" in this country and abroad that issue publications of interest in the work of the Department. To all who have kindly contributed to the library's resources, grateful acknowledgment is made.

The library is also indebted to the various bureaus that have turned over to it for cataloging a large number of books, pamphlets, and continuations purchased from special funds under their control. The Agricultural Adjustment Administration contributed 61 volumes purchased from its funds: Bureau of Agricultural Economics, 60; Commodity Exchange Administration, 26; Bureau of Entomology and Plant Quarantine, 109; Forest Service, 8; Graduate School, 5; Bureau of Public Roads, 3; Soil Conservation Service, 197; Solicitor's Office, 289, a total of 758 volumes. To this number should be added 223 pamphlets and 173 continuations, the grand total therefore being 1,154 items contributed in this way to the library's resources, as compared with 951 last year. Among such gifts special mention should be made of two notable and valuable accessions obtained through the cooperation of offices of the Bureau of Agricultural Economics. The first of these was a set of the publications of the Chartered Surveyors' Institution, London. This series is of importance in the valuation of real estate, especially in tenant-right valuation. The other important item in the field of agricultural economics was the following: Canadian Royal Grain Inquiry Commission. Record of Evidence and Proceedings. December 1, 1936–November 22, 1937, vol. 1—71, 91–121.

To the Bureau of Entomology and Plant Quarantine the library is indebted for the following two valuable works, which were a part of the Barnes collection acquired by the Bureau: Illustrations of North American Entomology, by Townend Glover, 1878; Neue Schmetterlinge der Insekten-sammlung. Von Fr. Klug. Berlin, 1836–56.

On July 1, 1939, the library contained 290,207 accessioned volumes and pamphlets. This number is exclusive of the periodicals, pamphlets, bulletins, and reports in temporary binders that have not been

accessioned. Neither does this number include the following special collections: Horticultural trade catalogs now numbering more than 60,000; pamphlet collection numbering approximately 7,000; reprint collection numbering approximately 26,000; and the United States Government documents, numbering approximately 12,000. None of these pamphlets and documents have been accessioned.

The number of cataloged accessions for the year, as compared with those received in the fiscal years 1935–38, is shown in table 1.

TABLE 1.—*Accessions to the library, fiscal years 1935–39*

Item	1935	1936	1937	1938	1939
Purchases:					
Volumes	1,177	2,015	2,485	2,870	2,620
Pamphlets	111	125	270	197	216
Maps (and charts)	5	35	15	80	15
Serials	327	280	292	200	350
Continuations	397	403	474	662	878
Total	2,017	2,858	3,536	4,009	4,079
Gifts and exchanges:					
Volumes	2,605	1,777	1,965	2,602	2,423
Pamphlets	2,280	1,436	1,404	1,749	1,657
Maps (and charts)	31	69	48	68	44
Continuations	6,060	4,404	5,129	6,979	7,408
Total	10,976	7,686	8,546	11,398	11,532
Bindery continuations	1,268	3,127	1,607	2,023	1,629
Volumes laced in binders	705	736	988	574	799
Total	1,973	3,863	2,595	2,597	2,428
Grand total	14,966	14,407	14,677	18,004	18,039

EXCHANGES

In connection with the work of obtaining foreign exchanges, lists are filed of the addresses of foreign institutions, societies, and officials to whom publications of the Department are sent in exchange. In addition to the sending of publications to the regular mailing lists, the library issues orders on the Division of Publications for the mailing of miscellaneous Department publications that are specifically requested. The number of such orders was 1,425, an increase of 38 as compared with the number during 1938. A regulation of the Department (No. 1375) provides that exchanges for Department publications be addressed to the library.

CATALOG DIVISION

HELEN M. THOMPSON, *Chief*

There was a decrease in the number of continuations cataloged as compared with the number for the previous year. Uncataloged items totaled 8,323, as compared with 6,759 in 1938 and 8,600 in 1937. These figures are exclusive of an uncataloged collection in the less well-known foreign languages that has been accumulating for several years because of the difficulty in cataloging them. The arrears in cataloging, due to insufficient help, would have been much greater if the Division had not had the help of assistants from the libraries of the Bureau of Agricultural Economics, Entomology and Plant Quarantine, and Plant Industry, the Forest Service, and the Soil Conservation Service in cataloging the arrears in the subjects of special interest to their respective bureaus. Help in the typing of the

catalog cards was furnished by the Bibliofilm Service through the detail to the library of a Works Progress Administration worker for 4 months. Mention should also be made of the help received through the assignment to the library of several National Youth Administration workers. They worked in this Division approximately 1,352 hours, assisting in the pasting of labels, simple filing, and typing.

Because of the necessity for cutting down work in the Division the library on January 3, 1939, began ordering only two cards from Library of Congress proof for publications not in the library, one to be filed under author entry in the general catalog, and one to be kept in a separate file to show entries for which only an author card appears in the catalog. In other words, the subject cards and added entries are no longer included for books not contained in the library. It is regretted that this omission is necessary, as it has been most helpful when bibliographical lists are being compiled and also in connection with the reference work, to have included under the various subjects the cards for books in the Library of Congress, as well as those contained in this library. It is hoped that at some future date the library will have sufficient help to include again both the subject and added-entry cards for Library of Congress books.

In the past year the library discontinued making analytical cards for the following four foreign series: (1) Die Landwirtschaftlichen Versuchsstationen; (2) Landwirtschaftliche Jahrbücher; (3) Annales Agronomiques; and (4) Paris. Institut National Agronomique. Annales. The first-named series ceased publication at the end of volume 129. Cards for the second-named series were made through volume 86, for the third-named series through volume 8, and for the fourth through volume 30. The number of subscribers for the printed Library of Congress cards for these series did not seem to justify the continuance of this service. The printing of the cards was begun in 1904.

Full statistics regarding the cataloging, including the number of cards added to the main catalog and to the various catalogs and indexes maintained by the branch libraries in the bureaus and divisions, are given in tables 2 to 4.

TABLE 2.—*Material cataloged, fiscal years 1935–39*

Item	1935	1936	1937	1938	1939
Volumes	3,782	3,792	4,450	5,472	5,043
Pamphlets	2,391	1,561	1,674	1,946	1,873
Maps and charts	36	104	63	148	59
Continuations and serials	6,784	5,087	5,895	7,841	8,636
Total	12,993	10,544	12,082	15,407	15,611
Bindery continuations	1,268	3,127	1,607	2,023	1,629
Volumes in binders	72	42	109	87	55
Additions to binders	705	736	988	574	799
Current entries	269	269	261	315	357
Changed titles	96	89	100	81	116
Closed entries			75	160	137
Total	2,410	4,263	3,140	3,240	3,093
Grand total	15,403	14,807	15,222	18,647	18,704
Pamphlets cataloged (by author only)	376	101	66	113	92
Reprints (reprint collection)	157	36	27	27	23

TABLE 3.—*Cards in the agricultural series prepared for printing and cards received, fiscal years 1935–39*

Item	1935	1936	1937	1938	1939
Cards sent to be printed:					
Accessions	325	307	367	400	334
Department publications	419	342	594	561	554
Agricultural periodicals	96	44	124	64	84
Total	840	693	1,085	1,025	972
Printed cards received:					
Accessions	306	327	344	348	330
Department publications	271	473	596	441	430
Agricultural periodicals	80	93	123	64	84
Total	657	893	1,063	853	844

TABLE 4.—*Cards added to various catalogs and indexes, fiscal years 1935–39*

Library	Cards added				
	1935	1936	1937	1938	1939
Main library	22,697	21,701	24,021	23,944	20,297
Agricultural Economics	16,470	23,061	18,533	19,057	19,165
Division of Cotton Marketing	1,543	2,850	4,072	913	808
Special index	2,646	2,561	2,947	3,538	4,149
Agricultural Engineering	500	2,311	2,560	1,809	2,496
Special indexes	2,600	5,000	4,722	6,152	2,752
Animal Industry	6,282	11,003	3,421	2,749	3,462
Animal Husbandry Division	210	505	675		
Commodity Exchange Administration				4,950	3,695
Special indexes				700	887
Dairy industry	2,051	1,679	1,366	1,326	467
Special indexes	174	152	330		334
Entomology and Plant Quarantine	1,904	3,743	2,191	2,597	4,827
Special indexes	3,500	12,310	12,578	10,660	11,671
Division of Bee Culture	1,000	1,000	850	780	500
Experiment stations	1,692	3,796	5,480	5,557	6,283
Special indexes	5,166	12,215	11,055	12,274	15,265
Forest Service	16,158	20,000	16,500	26,270	28,280
Home Economics	857	931	915	1,321	972
Plant Industry	26,675	[1] 28,466	[1] 29,561	[1] 29,697	29,480
Special indexes	1,237	3,605	1,439	3,268	2,772
Public Roads	20,193	3,930	3,061	8,730	6,665
Special indexes		12,500	16,000	19,404	18,800
Soil Conservation Service			3,471	3,100	2,669
Special indexes			1,619	1,791	1,548

[1] Revised figures.

PERIODICAL DIVISION

LYDIA K. WILKINS, *Chief*

Statistics regarding the number of periodicals and newspapers received currently during the fiscal years 1935–39, are given in table 5.

TABLE 5.—*Periodicals and newspapers currently received, fiscal years 1935–39*

Item	1935	1936	1937	1938	1939
Different periodicals received by purchase	1,384	1,390	1,461	1,478	1,500
Different periodicals received by gift and exchange	3,109	3,280	3,350	3,515	3,527
Total	4,493	4,670	4,811	4,993	5,027
Duplicate periodicals purchased	347	297	327	343	345
Duplicate periodicals received by gift and exchange	390	450	500	650	660
Total	737	747	827	993	1,005
Total periodicals received	5,230	5,417	5,638	5,986	6,032
Average number of periodicals received daily	275	274	283	301	297
Different dailies received	174	176	197	202	265
Extra copies received	47	42	64	66	90
Total dailies received	221	218	261	268	355
Farm bureau publications currently received	177	184	173	188	171

The average daily circulation of current periodicals in the library was 416. The total circulation of current periodicals in the library and the branch libraries in the bureaus is given in table 7.

SERIALS

Work was continued on the installation of the visible file for recording the current serials, namely, annual reports, proceedings, transactions, and other publications issued less than four times a year. The number of serials that are being currently received is 5,470, exclusive of United States Government publications.

Work was begun on the installation of the new visible file for the bindery records, as the old record on 5- by 8-inch cards had become cumbersome and difficult to use. New visible file cards have been made for approximately four-fifths of the entries. With the aid of a National Youth Administration student, about one-half of the extension publications have been rearranged, checked, and put in binders.

BINDING

The Binding Section has had another difficult year. It was again necessary to detail one of the binding assistants to the Current Periodical Section for several weeks. In the last quarter of the year an assistant from the Catalog Division was detailed to the Binding Section to help in reducing the arrears. Six National Youth Administration students spent, in all, 92 hours in the Binding Section putting periodicals in temporary binders. The statistics regarding the binding work are given in table 6.

TABLE 6.—*Binding work for fiscal years 1935–39*

Item	1935	1936	1937	1938	1939
Books and periodicals sent to bindery	5,121	5,206	4,966	3,707	4,154
Volumes placed in temporary binders	1,913	1,865	1,149	1,089	1,792
Total	7,034	7,071	6,115	4,796	5,946
Current serials added to binders	617	783	822	778	777

The arrears in binding have become a serious problem. This decrease in the amount of binding is due in part to the increase in binding costs and in part to insufficient help for the preparation of the volumes for binding.

READERS' DIVISION

EMMA B. HAWKS, *associate librarian,* in charge

The increase not only in circulation, but also in the reference use of the library, made it necessary to assign an additional assistant to the loan desk in order to keep abreast of the current work. This was done at the expense of the cataloging. There has been an increasingly active use of books and periodicals in the reading rooms and stacks, but it has not been possible to keep any records of such use, and it is not represented in any of the statistics kept by the Readers' Division. The circulation statistics that are kept do not, therefore, represent a true picture of the use of the library.

At the request of the Department graduate school, the library again was kept open after official hours during certain months of the school year to facilitate the use of books needed in a few classes in the school. Funds for paying the assistants were provided by the

graduate school. The number who used the library after hours was small, but many books were withdrawn from the special graduate school collection of books maintained in the library.

COMBINED CIRCULATION

The combined statistics of circulation in the main and the branch libraries, insofar as statistics are kept, are given in table 7. The Beltsville branch was established in 1938.

TABLE 7.—*Combined statistics of circulation, fiscal years 1938 and 1939*

Library	Books circulated								Current periodical circulation		Borrowers in 1939
	To individuals		To main library		To branch libraries		Total				
	1938	1939	1938	1939	1938	1939	1938	1939	1938	1939	
Main library	31,203	34,329	.....	.....	36,486	40,276	67,689	74,605	[1]110,000	[1]127,000	.....
Agricultural Economics	20,112	18,592	1,551	1,804	1,326	1,518	22,989	21,914	80,842	84,313	1,320
Division of Cotton Marketing	3,874	5,632	.....	.....	11	92	3,885	5,724	[1]44,000	38,400	54
Agricultural Engineering	4,017	5,101	333	509	101	134	4,451	5,744	13,272	[2]58,820	592
Animal Industry	5,921	3,848	419	478	25	343	6,365	4,669	48,241	41,660	107
Beltsville branch	.....	[2]	.....	[3]	.....	[3]	.....	2,553	.....	15,876	112
Chemistry and Soils	[4]	[2]	[4]	[2]	[4]	[2]	[4]	[2]	48,734	[3]	[3]
Fertilizer Research	[3]	[3]	[3]	[2]	[3]	[3]	[3]	[3]	2,084	2,330	78
Commodity Exchange Administration	[3]	1,336	[3]	[1] 25	[3]	[1] 25	[3]	1,386	[3]	14,042	67
Dairy Industry	2,299	2,930	144	137	54	27	2,497	3,094	30,398	38,104	84
Entomology and Plant Quarantine	4,932	4,709	561	680	18	11	5,511	5,400	26,884	25,211	182
Division of Bee Culture	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]
Experiment stations	2,647	2,955	[3]	[3]	[3]	[3]	2,647	2,955	29,636	27,637	138
Food and Drug Administration	[5]	[5]	[5]	[5]	[5]	[5]	[5]	[5]	22,615	23,483	[5]
Forest Service	7,960	6,979	728	863	368	418	9,056	8,260	[1]8,500	[1]12,000	700
Home Economics	3,844	3,181	350	408	[3]	[3]	4,194	3,589	15,975	17,331	101
Plant Industry	[5]	[5]	[5]	[5]	[5]	[5]	[5]	[5]	31,968	28,720	[3]
Public Roads	6,096	5,306	1,397	898	[3]	[3]	7,493	6,204	13,423	18,520	203
Soil Conservation Service	4,973	5,476	10	42	.....	4	4,983	5,522	[3]	46,567	167
Total	97,878	100,374	5,493	5,844	38,389	42,844	141,760	151,619	526,572	603,014	.....

[1] Approximate figures.
[2] Includes Chemistry and Soils circulation figures, the 2 bureaus having been combined in October 1938.
[3] Figures not available.
[4] Did not maintain a library in 1938; circulation figures included with those for the main library.
[5] Figures included with those for Agricultural engineering.
[5] The Food and Drug Administration and the Bureau of Plant Industry do not maintain collections of books, as they are in close proximity to the library. The circulation of books to members of these bureaus is, therefore, included with those for the library, but circulation figures are available for current periodicals, as this circulation is handled in the bureaus.

INTERLIBRARY LOANS

Interlibrary loans are divided into two classes: (1) Loans made to, and (2) loans made by, this library. Separate statistics are now kept of both the loans from and to libraries in Washington as well as of the loans from and to libraries outside of Washington.

Statistics of the number of loans to this library from libraries outside of Washington have been kept since 1911. These statistics show that the smallest number borrowed in any year was 35, in 1918, and that the number has exceeded 100 in only 2 years, namely, in 1932, when it was 102, and in 1937, when it was 143. In 1930, 50 books were borrowed from 25 different libraries outside the city. That it is necessary to borrow so few volumes from libraries outside of Washington is testimony to the comprehensiveness of the collections of Washington libraries.

Statistics of the number of books borrowed from other libraries in Washington, kept since 1911, show that the smallest number of

books borrowed in any year was 3,502 in 1923, and that the largest number was 6,784 in 1938. The number of such loans last year was 6,092. The 10 libraries from which the largest number were borrowed this year and the number of books borrowed were: Library of Congress, 5,031; Army Medical Library, 603; National Museum, 100; National Bureau of Standards, 69; Patent Office, 48; Geological Survey, 42; Weather Bureau,[2] 36; Public Health Service, 29; National Institute of Health, 24; Bureau of Fisheries, 22. These 10 libraries were the same 10 from which the largest number of books were borrowed during the 2 previous years.

The total number of books borrowed from libraries in and outside of Washington was 6,142. To this number should, however, be added 141 books that the Food and Drug Administration, through a special arrangement, borrowed direct from the Army Medical Library, making the total number borrowed by the Department 6,283, as compared with 6,872 last year.

A separate record has been kept for 4 years of the books borrowed by other Government libraries and by private institutions and organizations in Washington. This record shows that during 1936 these loans amounted to 3,544. In 1937 they totaled 2,048; in 1938, 1,465; and in the past year, 1939, 1,311. Fifty-eight different agencies in Washington outside of the Department used the library's facilities during the past year. All but 6 of these were Government offices. The 10 largest borrowers and the number of books borrowed were as follows: National Institute of Health, 312; National Museum, 151; Social Security Board, 80; Howard University, 69; Farm Credit Administration, 66; Bureau of Fisheries, 65; Bureau of Standards, 65; Patent Office, 52; Bureau of Mines, 48; and the Works Progress Administration, 46.

Statistics in regard to the books lent outside of Washington during the past 5 years are given in table 8.

TABLE 8.—*Interlibrary loans outside of Washington, fiscal years 1935–39*

Item	Books					Films or prints					Total				
	1935	1936	1937	1938	1939	1935	1936	1937	1938	1939	1935	1936	1937	1938	1939
Department of Agriculture field service	558	662	783	642	952	37	117	135	34	(1)	595	779	918	676	(1)
Land-grant colleges and experiment stations	797	554	504	470	582	309	604	667	863	(1)	1,106	1,158	1,171	1,333	(1)
Other colleges, universities, and organizations	280	264	261	229	315	248	560	841	996	(1)	528	824	1,102	1,225	(1)
Commercial firms	60	51	21	14	34	370	596	1,670	1,504	(1)	430	647	1,691	1,518	(1)
Individuals	64	18	17	15	17	69	145	437	403	(1)	133	163	454	418	(1)
Foreign organizations and individuals	39	17	22	7	17	45	184	316	373	(1)	84	201	338	380	(1)
Total	1,798	1,566	1,608	1,377	1,917	1,078	2,206	4,066	4,173	7,007	2,876	3,772	5,674	5,550	8,924
Unclassified:															
Photostat copies										(1)	28	27	7	1	
Typed copies										(1)	18	20	2	3	
Grand total	1,798	1,566	1,608	1,377	1,917	1,078	2,206	4,066	4,173	7,007	2,922	3,819	5,683	5,554	8,924

[1] Classification of requests for films from institutions, organizations, firms, and individuals discontinued in January 1939.

[2] Though the Weather Bureau is connected with the Department, the books borrowed from that library have, for the past 25 years, been considered interlibrary loans, as the books belonging to the Weather Bureau are not cataloged in the catalog of the Department Library and have never been incorporated with its collections.

In these interlibrary-loan statistics have been included not only the number of books lent and the photostat and typed copies of articles supplied, as had been customary for many years previous, but also the number of film copies and photographic prints that have been supplied since November 1934, when the library inaugurated the Bibliofilm Service to supply film copies of articles in lieu of sending the volumes themselves. The total number of requests that have been met by the lending of volumes or the furnishing of films or prints shows a gain of more than 200 percent over the number in 1935 in the use of the library's resources by institutions, organizations, firms, and individuals located outside of Washington. Because of the increase in the number of requests received for film copies and the consequent work involved, it became necessary in January 1939 to discontinue the classification of the orders for films and prints according to the institutions, organizations, firms, and individuals from whom they were received. It is, however, quite certain that commercial firms continue to be the largest users of the Bibliofilm Service. A more detailed description of the film-copying service is given in the following paragraphs from the report of Mrs. Roberta C. Watrous, bibliographical assistant, who has charge of the work of the library in connection with the Bibliofilm Service.

BIBLIOFILM SERVICE

The Bibliofilm Service, formerly operated by Science Service, became a part of the newly organized American Documentation Institute on July 1, 1937. Cooperation of the library with the Bibliofilm Service has continued as before. The library has procured the books, carried on much of the necessary bibliographical work, and furnished the office and laboratory space for the Bibliofilm Service. The American Documentation Institute has conducted the business and financial end, as well as the routine and experimental photographic work.

During the year an important change in the procedure for handling orders for microfilm and photoprint copies of publications was made because of the great increase in the number received. Prior to January 1, 1939, almost all such orders received by the Bibliofilm Service were sent to this library without prior elimination of those pertaining to publications definitely not within the scope of this library. When received by the library the orders were examined to determine whether the publications referred to were available in this library and, if not, whether they might be available in one of the other libraries in Washington cooperating with the Bibliofilm Service. Since January 1, a preliminary distribution of orders has been made by the Bibliofilm Service, which has resulted in sending many to the other cooperating libraries where they could probably be filled, instead of sending all first to this library. According to figures received from the Bibliofilm Service, 11,510 orders were received during 1939, of which 9,715 were sent to this library to be filled and 1,795 to other cooperating libraries. Of those sent to this library, 210 had been sent first to some other library. There has been an increase of 58 percent in the number of orders received and 59 percent in the number of orders filled during the year. In 1938 orders were received for a total of 6,117 items, of which 4,404 were filled and 1,713 were not filled. In 1939, orders were received for 9,715 items, of which 7,007 were filled and 2,708 were not

filled. The largest number of orders [3] received in any month was 1,378, in November 1938. Of these, 572 were part of an order received by Bibliofilm Service from a commercial firm for over 1,600 items. By special arrangement, these orders had been marked to indicate the libraries in which they could probably be filled. Only those orders indicating no other Washington library were sent to this library for searching, namely, 572. Of this number it was possible to supply only 89, as the subject matter was largely outside the scope of this library.

The smallest number of orders received in any month was 589, in September 1938. Of these, 423 were filled.[4] The average number of orders received monthly was 809. The average number filled was 584. In the fiscal year 1938 the corresponding averages were 510 and 367.

Detailed statistics of the number of orders received, filled, and not filled are given by months in table 9.

TABLE 9.—*Orders received, filled, or not filled, 1938–39*

Month	Orders received	Orders filled	Orders not filled	Month	Orders received	Orders filled	Orders not filled
July	614	437	177	February	936	688	248
August	670	452	218	March	801	665	136
September	589	423	166	April	823	686	137
October	790	533	257	May	866	711	155
November	1,378	668	710	June	659	502	157
December	706	533	173				
January	883	709	174	Total	9,715	7,007	2,708

BIBLIOGRAPHICAL WORK

Two additions were made to the mimeographed series of the library entitled "Bibliographical Contributions." These were No. 33, References on American Colonial Agriculture, and No. 34, References on Agriculture in the Life of the Nation. Both were prepared by Everett E. Edwards, of the Division of Statistical and Historical Research, Bureau of Agricultural Economics. The publication of Agricultural Library Notes, the monthly mimeographed publication of the library, was continued and the numbers contained 710 pages as compared with 698 pages in the previous year. The edition is 1,725 copies, as in 1938.

BUREAU OF AGRICULTURAL ECONOMICS LIBRARY

The following numbers were issued in the mimeographed series of Agricultural Economics Bibliographies:

No. 74. The Soybean Industry. A Selected List of References on the Economic Aspects of the Industry in the United States, 1900–1938. Compiled by Helen E. Hennefrund and Esther M. Colvin. 474 pp. Processed. October 1939.

No. 75. The Tobacco Industry. A Selected List of References on the Economic Aspects of the Industry, 1932–June 1938. Compiled by Louise O. Bercaw. 337 pp. Processed. September 1938.

[3] No distinction is made between items and orders. All references are to individual items, although several or many of these may be received at the same time from the same customer.

[4] An order is deemed filled when the book called for is sent to the Bibliofilm Service, although for reasons beyond our control the transaction may not be completed.

No. 76. Agricultural Relief Measures Relating to the Raising of Farm Prices—75th Congress, January 5, 1937, to June 16, 1938. Compiled by Marion E. Wheeler and Mamie I. Herb. 100 pp. Processed. February 1939.

No. 77. Part-time Farming in the United States. A Selected List of References. Compiled by Helen E. Hennefrund. 272 pp. Processed. February 1939.

No. 78. Rural Psychology. A Partial List of References. Compiled by Margaret T. Olcott. 76 pp. Processed. March 1939.

Because of the demand for some of the typewritten lists of references noted currently in Agricultural Economics Literature, it was decided to begin a new mimeographed series called Economic Library List. Three lists were issued in this series in the past year, as follows:

No. 1. State Trade Barriers. Selected References. Compiled by Louise O. Bercaw. 16 pp. Processed. March 1939.

No. 2. The Frozen Food Industry. Selected References, January 1937 to March 1939. Compiled by Helen E. Hennefrund. April 1939. 14 pp. Processed.

Revision of a typewritten list, The Frozen Food Industry, 1937–38, compiled by Catharine L. Whitehorn, December 20, 1938.

No. 3. High Drafting in Cotton Spinning. Selected References. Compiled by O. M. Shipley, Division of Cotton Marketing Branch Library. 12 pp. Processed. April 1939.

As in previous years, 10 numbers of the mimeographed publication entitled "Agricultural Economics Literature" were issued. It now goes to 1,212 domestic addresses and to 242 foreign addresses.

The Division of Cotton Marketing library (a branch of the Bureau of Agricultural Economics library) continued the monthly mimeographed publication entitled "Cotton Literature." This is issued in cooperation with the libraries of the Bureaus of Entomology and Plant Quarantine and of Plant Industry.

At the meeting of the agricultural libraries section of the American Library Association in San Francisco, Calif., on June 23, 1939, it was announced that the Bibliography on Land Utilization, 1916–36 (Miscel. Pub. No. 284), compiled by Louise O. Bercaw and Annie M. Hannay, of the Bureau of Agricultural Economics library staff, had been awarded the Eunice Rockwood Oberly memorial prize and that the first honorable mention had been given to The Soybean Industry (Agricultural Economics Bibliography No. 74) compiled by Helen E. Hennefrund and Esther M. Colvin, also of the Bureau of Agricultural Economics library staff.

BUREAU OF AGRICULTURAL ENGINEERING LIBRARY

The monthly mimeographed publication entitled "Current Literature in Agricultural Engineering" was continued. There were also issued in mimeographed form the following short lists: Artificial Drying of Farm Crops in the United States, 46 pages; Refrigerator Lockers, 6 pages; Electric Fencing, 3 pages; Magazines Contributing to Current Literature in Agricultural Engineering, 26 pages.

COMMODITY EXCHANGE ADMINISTRATION LIBRARY

The Commodity Exchange Administration library began to issue in January 1938 a mimeographed monthly publication entitled "Commodity Exchange Administration Literature." The mimeographing of the list was discontinued with the February 1939 issue, but it is still issued in typewritten form for the use of the offices of the Ad-

ministration. The list of publications issued by the Administration was revised and issued in May 1939 as C. E. A.—12 rev. A bibliography of 65 pages, entitled "Futures Trading in Agricultural Commodities: a Selected List of References," compiled by C. Louise Phillips-Corbett, was issued in August 1938 as C. E. A.—16. A supplement of 11 pages was issued in February 1939 as C. E. A.—16, supplement.

BUREAU OF DAIRY INDUSTRY LIBRARY

A revision of the following mimeographed list was issued: Dairy Library List No. 4, Partial List of Periodicals Relating to the Dairy Industry. Work is in progress on a Bibliography on Dairying in the United States, 1930–39.

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE LIBRARY

Work has progressed steadily on Index VI to the Literature of American Economic Entomology, 1935–39, compiled under the direction of Mabel Colcord, librarian of the Bureau. The index is practically up to date and will be ready for publication early in 1940. It is a cooperative undertaking of the Bureau and of the American Association of Economic Entomology.

Entomology Current Literature, a mimeographed publication issued bimonthly, was continued. The file for the year contained 188 pages, as compared with 156 for 1938.

The author and subject indexes of bureau printed publications were kept up to date, as well as those for the numbered mimeographed publications of the Bureau, and 18 brief typewritten bibliographical lists were prepared, among which were the following: Bibliography of the Effect of X-ray on Insects, 4 pages, August 1938: Effect of Infra-Red Rays on Insects, 2 pages, March 1939: Insect Tropisms, 2 pages, July 18, 1938: Insects of Latin American Countries, 6 pages, March 23, 1939: Ultra-Violet Ray: Effect on Insect Life, 3 pages, August 1938.

OFFICE OF EXPERIMENT STATIONS LIBRARY

The ninth supplement to Department Bulletin 1199, List of Bulletins of the Agricultural Experiment Stations for the calendar years 1937 and 1938, prepared by Catherine E. Pennington, is in press and will be issued as Miscellaneous Publication No. 362. Marked progress has been made on the subject index to Department Bulletin 1199, which includes bulletins published from the establishment of the stations to the end of 1920, and supplement 1 covering the years 1921 and 1922. It is hoped that these lists and succeeding lists through 1930, now out of print, will be republished. A complete indexed list of the bulletins issued from the organization of the stations, for which there is increasing demand, will thus be made available.

The library of the Office of Experiment Stations continued to prepare the mimeographed Monthly List of Station Publications and the Monthly List of Extension Publications. The former is separately issued, but the list of extension publications appears only in Agricultural Library Notes.

The list of articles by members of the agricultural experiment stations' staffs appearing in scientific journals and in the proceedings of

scientific societies is prepared each month by the Office of Experiment Stations library. This list has been regularly issued in Agricultural Library Notes since September 1933. The number of articles appearing in these lists during the past year was 3,362, an increase of 37 over the number in the previous year. There was prepared in typewritten form for the use of the joint committee on projects and correlation of research, Association of Land-Grant Colleges and Universities, a preliminary list of bibliographies and reviews of agriculture and home economics for the period 1927 to October 1938. The list comprises 75 pages.

BUREAU OF PLANT INDUSTRY LIBRARY

Plant Science Literature, a mimeographed weekly list, was issued throughout the year. The edition of this list at the end of June was 1,340 copies, 235 of which are distributed to Department employees in Washington, 340 to field stations and employees, 620 to libraries and scientific institutions outside the Department in this country, and 145 to scientists and institutions abroad. The bulk of the references appearing in Plant Science Literature are incorporated in the botanical catalog maintained by the Bureau of Plant Industry library.

Marked progress was made on the bibliography of Early Horticultural Literature, a Checklist of Sixteenth, Seventeenth, and Eighteenth Century Works on Horticulture, the joint work of Marjorie F. Warner, senior author, and Janice S. Brown. Miss Warner, who before her retirement was connected with the Bureau of Plant Industry library staff, has been giving her time to the completion of the bibliography. The work still to be done includes entries for the works of Columella, Crescenzi, Palladius, Varro, and Vergil, added entries, notes, references, and locations, especially in the first part of the list, and revision of some of the anonymous and title entries such as the Geoponika and the Scriptores Rei Rusticae.

The Bibliography of the Floras of the World, which Alice C. Atwood has been compiling, in cooperation with Sidney F. Blake, of the Division of Plant Exploration and Introduction, has been brought to completion, as nearly as is possible, for the Western Hemisphere, Africa, and the insular floras. It is hoped that this portion will be printed in the near future.

BUREAU OF PUBLIC ROADS LIBRARY

Highways Current Literature, a monthly mimeographed list, was issued throughout the year. The edition is now 445 copies. The only important bibliography issued was Bibliography on Highway Finance, compiled by Mildred Wilson Helvestine, 95 pages, mimeographed, November 1938.

SOIL CONSERVATION SERVICE LIBRARY

Soil Conservation Literature, begun in January 1937 as a monthly mimeographed publication, has been continued. The numbers contained 175 pages as compared with 143 in 1938. The edition is now 665 copies. In response to specific requests, various short special lists on soil-conservation subjects were issued in typewritten form.

TRANSLATIONS

The library has continued its cooperation with the Department Interbureau Committee on Translations, of which H. B. Humphrey,

Bureau of Plant Industry, is chairman, in furthering the translation exchange service project. In addition to the translations received from bureaus and offices of the Department, the library has received translations from cooperating land-grant colleges or experiment stations in Iowa, Kansas, Minnesota, New Hampshire, North Carolina, Ohio, Oregon, and West Virginia. In many cases carbon copies or the original copies are given to the library. In other cases, the original copies are lent for the purpose of having film copies made. The translations received are regularly listed in Agricultural Library Notes, except botanical translations, which are listed in Plant Science Literature. A card record of all the translations available is also nearly completed, and a more orderly procedure has been devised for the recording and filing, not only of the translations received by the Library but also of those received by the various branch libraries in the bureaus.

In addition to a number of translators who are regularly employed by the bureaus of the Department, eight translators are officially attached to the library in order that they may be available to meet miscellaneous demands from offices of the Department for translating work. These translators have no regular salaries, being paid by the hour only while actually employed on translations specifically requested. The translations are thus paid for by the various offices of the Department that request them. This elastic arrangement has met a real need because of the unevenness of the demands for translating work. The eight translators are able to furnish translations from one or more of the following languages: Danish, Dutch, French, German, Italian, Japanese, Portuguese, Russian, Spanish, and Swedish.

BUREAU AND OFFICE LIBRARIES

At the close of the year there were 15 branch libraries in the bureaus and offices and 3 subbranches, making 18 branch library units located in Washington and Beltsville, Md. A list of these various libraries, their locations, the size of their collections, and other data regarding them are given in table 10.

TABLE 10.—*Summary of statistics of bureau libraries, 1939* [1]

Bureau or office, location, and name of librarian	Employees	Books	Pamphlets	Periodicals currently received	Registered borrowers	Registered borrowers to whom periodicals are circulated	Shelving	Space occupied
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Linear feet*	*Square feet*
Agricultural Economics, South Building, Mary G. Lacy	27	[2] 100,835	.....	2,602	1,320	167	4,947	7,073
Cotton Marketing, 12th and C Sts. SW., Emily L. Day	2	683	2,728	351	54	55	228	1,096
Agricultural Engineering, South Building, Mrs. Dorothy W. Graf	3	[3] 6,544	[3] 11,530	940	592	229	1,545	1,378
Animal Industry, Administration Building, East Wing, Mary F. Thompson	3	(4)	(4)	837	107	109	119	540
Beltsville Branch, Beltsville, Md., Dorris A. Brown	1	[3] 2,500	(5)	525	112	105	537	[3] 2,100

[1] The Weather Bureau library is administered separately, with the exception that the books and periodicals are purchased from the appropriation of the library of the Department, the sum of $1,000 being set aside each year for this purpose.

[2] Includes pamphlets.

TABLE 10.—*Summary of statistics of bureau libraries, 1939*—Continued

Bureau or office, location, and name of librarian	Employees	Books	Pamphlets	Periodicals currently received	Registered borrowers	Registered borrowers to whom periodicals are circulated	Shelving	Space occupied
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Linear feet*	*Square feet*
Commodity Exchange Administration, South Building, Mrs. C. Louise Phillips-Corbett	3	2,353	[3] 600	183	67	17	1,237	464
Dairy Industry, South Building, Carrie B. Sherfy	3	1,571	[3] 6,000	382	84	73	495	639
Entomology and Plant Quarantine, South Building, Mabel Colcord	7	14,489	16,011	1,048	182	93	2,190	2,333
Bee Culture, Beltsville, Md., Ethel L. Coon	1	2,500	875	85	(5)	(5)	624	823
Experiment Stations, South Building, Cora L. Feldkamp	9	4,741	114,121	1,042	138	83	1,806	2,650
Fertilizer Research, Nebraska & New Mexico Ave. NW., Mrs. Lee Garby	1	[3] 5,135	(5)	125	78	43	623	1,260
Forest Service, Atlantic Building, Mrs. Mildred B. Williams	2	[2] 32,567	----------	500	700	350	1,737	1,952
Home Economics, South Building, Mrs. Mamie F. Nystrom	1	[3] 5,000	(5)	337	101	93	693	767
Plant Industry, South Building, Jessie M. Allen	10	[4] 508	(5)	553	(5)	159	140	650
Public Roads, Willard Building, O. Louise Evans	4	[3] 22,159	[3] 26,001	418	203	175	2,627	2,209
Soil Conservation Service, Columbian Building, Mildred C. Benton	6	1,930	1,582	281	167	81	474	917
Solicitor's Office, South Building, Francis D. Scott	2	7,339	250	11	(5)	(5)	1,914	1,679
Weather Bureau, 24th & M Sts. NW., Richmond T. Zoch	6	[3] 55,000	(5)	182	(5)	(5)	(5)	(5)

[3] Approximate figures.
[4] Does not maintain a collection of books.
[5] Figures not available.

Because of lack of space it is impossible to print in full the reports of the branch libraries. Cataloging statistics are included in table 4, and statistics of circulation are given in table 7. The bibliographical work and other regular activities are described in the body of the report under their appropriate headings. For the most part, the work has been carried on along the lines described in previous reports but there were some new developments that should be mentioned.

In October 1938, the Bureau of Agricultural Engineering and the Bureau of Chemistry and Soils were combined. The latter Bureau had not maintained a branch library since June 1935, when the Bureau was moved to its new quarters in the South Building. The collections of chemical books and periodicals formerly filed in the Bureau of Chemistry and Soils library were amalgamated at that time with the collections in the main library. A branch library had, however, been continuously maintained by the Bureau of Agricultural Engineering. When the two Bureaus were combined, the librarian of the Bureau of Agricultural Engineering, Mrs. Dorothy Graf, was requested by the new Bureau to take charge of the library for the combined bureaus. The collections of the Bureau of Agricultural Engineering were moved in November 1938 from rooms 5028–5032 in the South Building to the new library quarters for the com-

bined bureaus in rooms 5104–5108 and 5109–5111, South Building. Later, many of the sets of chemical periodicals that had been filed in the Bureau of Chemistry and Soils library previous to the amalgamation of the collections with the library in July 1935 were, at the request of the new Bureau, withdrawn from the library for filing in the new library quarters of the Bureau. As the change in the name of the combined bureaus could not take effect till July 1, 1939, the report on the library of the combined bureaus is presented as the report of the library of the Bureau of Agricultural Engineering.

In connection with the Bureau of Animal Industry Library service Beltsville branch was opened on August 10, 1938, to serve all divisions of the Bureau at the Agricultural Research Center, Beltsville, Md. Dorris A. Brown, who had had experience in the library and in the branch libraries in the Bureaus of Agricultural Economics and of Chemistry and Soils, was placed in charge of the new library. Further details in regard to the library are given in connection with the description of the library facilities at the Agricultural Research Center.

A branch of the Bureau of Entomology and Plant Quarantine is maintained at the Agricultural Research Center in connection with the Division of Bee Culture. The library facilities for apicultural work were materially enhanced when the Division of Bee Culture established a sublaboratory at Madison, Wis., in cooperation with the University of Wisconsin. By the terms of the cooperative agreement with the university, the Bureau has taken over practically all the beekeeping work formerly done by the State, and also the coguardianship of the Miller Memorial Beekeeping Library, which is without doubt the best collection of beekeeping literature in this country, if not in the world. This library, maintained as part of the agricultural library of the university, consists of approximately 3,000 books and pamphlets and 4,000 volumes of periodicals occupying approximately 500 linear feet of shelves. H. F. Wilson, in charge, Department of Economic Entomology, University of Wisconsin, has been custodian of the library since its establishment in 1923 in honor of the noted apiculturist C. C. Miller. Largely through the efforts of Professor Wilson, the material has been greatly augmented, especially through the acquisition of the collection of bee books formerly belonging to H. J. O. Walker of England, which includes many rare books and first editions. Ethel L. Coon, librarian, Division of Bee Culture, in the spring of 1939, after consulting with members of the staff of the agricultural library, University of Wisconsin, and others, undertook, as the first step in the organization of the Miller Library, the classification of the collection by subjects, using a system similar to that employed in the Library of Congress for apicultural literature. This library represents, therefore, an interesting experiment in library cooperation between a State agricultural college library and the library of the Department.

The Office of Experiment Stations library, in continuance of the cooperative arrangement that has existed between the Office of Experiment Stations and the Extension Service since the establishment of the two offices, continued during the past year to furnish the special library service needed by the two offices. The major part of the work for the Office of Experiment Stations is in connection with the Experi-

ment Station Record. Owing to the large volume of material now issued by the State experiment stations, the space in the Record for abstracts of other material is limited. Therefore, the selection and assignment to the Record editors of new material not issued by State stations is becoming increasingly difficult, involving as it does an evaluation by the library staff of the incoming material to avoid the circulation to the editors of material that they cannot use. The major part of the work for the Extension Service is the maintenance of the collection of State extension publications. This collection is increasing in usefulness. A subject catalog for the collection is kept up-to-date, making possible ready identification of extension publications and the preparation of bibliographies showing the extension publications on various subjects. There was prepared again this year an exhibit of books for display at the Thirteenth National 4–H Club Camp, held June 15–21, 1939. The display was well placed and received favorable comment from many club leaders.

The work of the Forest Service library, in Washington, is made difficult by the fact that the offices of the Service are much divided, some of them being located in the Atlantic Building, 930 F Street NW., and others in the South Building, not far from the library. During the coming year it is planned to make a special survey of the problems in an effort to work out more satisfactory service to both groups. If all the collections were located in the South Building, it is believed a more prompt service could be given not only in the circulation of books and periodicals but also in the reference and bibliographical work. A special effort was made to further cooperation among all the libraries of the Forest Service located outside of Washington. There are now 9 regional libraries and 14 field libraries. In order to become more familiar with their problems and thus to be better able to help them, all the regional offices except Alaska and all experiment stations except the Southwestern were visited by the librarian or assistant librarian during the year. A number of these regional and field libraries have professional librarians in charge who are performing most satisfactory service. The regional libraries in particular are making efforts to extend their service also to the supervisors' offices in their regions and to the men in the forests. Several of the librarians of the regional libraries located in the West attended the meeting of the American Library Association in San Francisco in June 1939. The librarian of the southern region, stationed at Atlanta, Ga., spent 2 weeks in May 1939 on detail to the Forest Service library in Washington.

The Soil Conservation Service library was transferred in May 1939 from the Division of Research to the Division of Information. This will, it is believed, facilitate the administration and supervision of regional office libraries organized in the regional divisions of the Division of Information. A manual for the Soil Conservation Service regional libraries, prepared by the librarian of the Service and issued in the summer of 1938, outlined in detail the requisites, functions, and procedure of a library and indicated the desirability of the organization of the Soil Conservation Service regional libraries as subbranches of the Service library in Washington, with cataloging and bibliographical work centralized. For the most part, those in charge of these field libraries are attempting to follow the sugges-

tions in the manual, but because of inexperience and lack of professional training, some of those in charge of these field collections have not yet fully appreciated the advantages of the cooperative connection with the Service library in Washington, which itself is a branch of the Department library, and able to take advantage of the resources of all Government libraries in Washington. In an effort to become acquainted with the needs of regional libraries, the librarian of the Soil Conservation Service visited the offices located at Spartanburg, S. C., Amarillo, Tex., Forth Worth, Tex., Albuquerque, N. Mex., Salina, Kans., Berkeley, Calif., and Spokane, Wash.

The demands from the field, particularly upon the Soil Conservation Service library and the Forest Service library, not only from their field libraries but also from employees of these Bureaus located at remote places with no library facilities, are increasing and are presenting difficult administrative problems, both as to the extent and kind of service that it is feasible for these branch libraries and the Department library to render to workers and offices of the Department located outside of Washington. Some general and consistent policies will need to be formulated during the coming year, particularly as such demands on the Department library are likely to increase still more because of the establishment of the four new regional laboratories of the new Bureau of Agricultural Chemistry and Engineering. Although good working libraries are planned in connection with these laboratories, it seems improbable that these libraries can be sufficiently extensive to meet all the needs of the laboratories for literature. To supplement the service of their own and neighboring local libraries, the laboratories will naturally turn to the Department library. In this service the furnishing of film copies, of periodicals at least, seems likely to play an important part.

LIBRARY FACILITIES AT THE AGRICULTURAL RESEARCH CENTER

Up to the last fiscal year the only library unit located at the Agricultural Research Center with a librarian in charge was the Division of Bee Culture, a branch of the Bureau of Entomology and Plant Quarantine library. As the Division of Bee Culture and its library were formerly located at Somerset, Md., the transfer to Beltsville 4 years ago did not present any new and more difficult problems. Moreover, complications in connection with the sending of books and periodicals to Beltsville for the use of the Division were less than in the case of most offices, as apicultural literature is of little interest in the work of other offices. If this unit had been more centrally located and its collections of more general interest, it might have been the nucleus of a more general library service for Beltsville, but under the conditions which existed this was not practicable. Even if a central library is provided in Beltsville, it will probably be advisable for the Division to continue to have its special collection of apicultural literature, as the advantages in connection with the maintenance of a small special collection outweigh the disadvantages if the literature covered is seldom needed by other offices.

At the Bureau of Dairy Industry laboratories located at the Agricultural Research Center, a plan for providing library service for the workers there has been in the process of development for a num-

ber of years, for the Bureau was carrying on investigations in Beltsville previous to the establishment of the Research Center. A collection of the books and periodicals of special interest in dairy investigations has gradually accumulated. Various periodical sets and important reference books have been purchased from the funds of the Bureau, and some have been furnished by this library. During the past year the sum of $390.41 was spent on books and periodicals by the Bureau. The collection now consists of approximately 4,000 volumes. Recently the Bureau set aside an attractive 20- by 38-foot room on the first floor of its main building for its library collection. Current periodicals and books supplied from the Department library are circulated through the Bureau of Dairy Industry library in Washington, which has general supervision over the branch-library unit in Beltsville, but no trained librarian is stationed there. The charging of the books and periodicals after they reach Beltsville is attended to by a clerical assistant whose office adjoins the library room. The Bureau has preferred this arrangement, including the purchasing from its funds, of the books and periodicals which it needs for filing at Beltsville, and it is probable that it would prefer to continue the present plan rather than to contribute any of its funds toward the salary of a trained librarian to look after its collection, even if most of the needed reference books and periodicals could be purchased for the Bureau by the Department library. For the time being, the present arrangement may be the best solution, but with the expansion of the investigations of the Bureau at Beltsville, with changes in personnel, and with the growth of the library collections, some other arrangement may be necessary.

The Horticultural Field Station of the Bureau of Plant Industry, located at Beltsville, though considered part of the Agricultural Research Center, is about 2 miles from the main buildings of the center. Because of this distance, the station will probably not be much benefited by any central library service that may be provided at the center, unless the collection of books maintained there is comprehensive enough to provide most of the books and periodicals that the station may have occasion to need. At present no room is available for a library collection in any of the buildings of the horticultural station. The Bureau of Plant Industry Library in Washington formerly circulated books and periodicals to the station, but the regular circulation of periodicals has been discontinued. This was by direction of the head of the Division of Fruit and Vegetable Crops and Diseases, as adequate assistance could not be provided to keep records of the journals at the station. The book circulation has also been curtailed. In lieu of paying for the services of a library assistant to circulate the library copies, a limited number of books and periodicals have been purchased from project funds of the Division for filing at the station. The circulation of these publications is handled informally by the various offices interested. Members of the station staff are encouraged to come to Washington to consult other publications needed. As far as the library is concerned, this is considered only a temporary arrangement. Later some more satisfactory library service will probably be provided for the horticultural station.

In 1937 the Bureau of Animal Industry, in anticipation of its need for a special library service at the Agricultural Research Center,

equipped an attractive room in the Nutrition Building as a library, but funds for providing the service were not available until August 1938, when the Beltsville branch of the Bureau of Animal Industry library was established and a trained librarian placed in charge. It is the first library unit to be definitely established to meet the new conditions existing at the Agricultural Research Center. With only a small collection of publications, chiefly bound volumes of Department publications, and a few sets of chemical journals, lent by the Chief of the Nutrition Division of the Bureau, the new library was faced first with the problem of providing a satisfactory circulation system for current periodicals and books needed by the staff. In other words, its problem was to provide the books and periodicals and the same kind of library service that had been available to members of the staff when they were located in Washington. The problem was, however, much more difficult, not only because of the distance of the new library unit from its supply depot, the Department library, but also because the scientific workers served by the unit were scattered over an area of several square miles in 10 different buildings. Transportation and communication facilities were accordingly most important if satisfactory service was to be maintained. When the branch was opened, such facilities were entirely inadequate, and efforts were at once made to improve them, but it was not till early in the spring of 1939 that they were at all satisfactory. It is now possible to fill special requests for books borrowed from Washington in 6 to 18 hours. Requests from any Beltsville office or laboratory of the Bureau of Animal Industry for books or periodicals on file in the Beltsville branch in the Nutrition Building can usually be filled in less than 2 hours (except those from the Animal Disease Station, which has only one delivery a day). In November 1938, when several offices of the Animal Husbandry Division of the Bureau were moved from Washington to Beltsville, the library acquired a number of volumes that had previously been filed in the former Animal Husbandry branch library. For several weeks the Bureau library in Washington continued to care for the circulation to them of the current periodicals, but as rapidly as possible the circulation records were transferred to record cards in the Beltsville branch. This additional circulation load made it necessary to add the services of a part-time assistant. By December it became evident that the demand for certain journals in the field of veterinary science, nutrition, chemistry, and genetics was so continuous that file copies would be necessary for the Animal Disease Station. A number of additional copies were therefore purchased, but there is need for much more duplication to improve the service. It is sometimes 10 days or 2 weeks before special requests can be filled in the case of current periodicals that have long circulation lists to offices in Washington.

Next to additional file copies of current periodicals, the library's chief need is for selected sets of the most-used periodicals, as this would eliminate the continual shuttling of the same volumes back and forth between Beltsville and Washington. Increased use of microfilm copies will also be an important aid to the service by making it possible for each scientist to build up his own permanent collection of papers pertinent to his particular field. The Beltsville branch library has available one microfilm reader in the Nutrition Building and it is

hoped that in the near future others will be provided for other buildings. This new library unit has become a necessity for the Bureau of Animal Industry workers at the Agricultural Research Center, but it has also been to a certain extent an experiment. While established to meet the needs of one bureau, it provides on a small scale a type of library service that may possibly be best suited to the Agricultural Research Center as a whole.

In the preceding paragraphs descriptions have been given of the library facilities now existing at the Agricultural Research Center. These descriptions have been made somewhat detailed in order to make clear the picture of each unit. In addition, it is desired to call attention to some of the difficult problems in library service that the center as a whole presents at this stage of its development. Located as the center is, 15 miles from Washington, and covering an area of approximately 12,000 acres, with experiments being carried on at present by seven bureaus of the Department and with plans being made to transfer to it in the near future the laboratory work of two or more other bureaus, with scientific workers conducting their investigations at present in 30 different buildings, with 10 buildings nearing completion and others planned, with the various groups of buildings so widely scattered that special transportation between them is necessary, the center presents conditions differing widely from those under which library service is furnished to scientific workers stationed in Washington. Yet whether stationed at the center or in Washington, they have the same needs. It is important, therefore, that serious consideration be given by the Department to these new problems, in order that adequate library plans for the future may be evolved for a branch library service for the center as a whole and that a definite administrative set-up for such a library unit may be provided by departmental authorization.

From the administrative point of view, one of the first questions that needs to be considered is that of funds. The fact that the Research Center has a field status makes it legally possible for the various offices located there to use their funds for the purchase of books and periodicals. A definite and consistent policy in regard to such purchases needs, therefore, to be decided upon. In view of the library's present very limited funds and since it has not yet been provided with additional funds, either for books or salaries, to meet the increased demands created by the establishment of the center, it seems advisable for the offices, in the meantime, to continue to use their funds for the purchase of the special books and periodicals that they need, thus supplementing the library's resources. The present somewhat chaotic system of book buying by individual offices and divisions with no central record of the purchases results, however, in unnecessary duplication and in limiting the usefulness of the books and periodicals purchased. In the interest, therefore, of better administration and to insure the maximum usefulness of the books and periodicals that are purchased by the various offices, it is important that a complete central record of such purchases should be available in the library. A procedure should, it is believed, be required in the case of purchases at the Agricultural Research Center such as was set up during the past year by Department Regulation No. 4114 in connection with books purchased for use in Washington,

from the funds of those offices of the Department that have authority by law for the purchase of books and periodicals. This regulation requires that a central record of such purchases be kept in the library and that the books and periodicals thus purchased be regarded as constructively the property of the Department library, even though filed, if desired, in the offices from whose funds they were purchased. A similar procedure could easily be followed at the Agricultural Research Center with the same advantages.

Another important question needing immediate consideration is the question of library quarters to be provided at the Agricultural Research Center. Looking forward to the time when nearly all the scientific work of the Department may be carried on there, thought should be given as to which of the following plans will best meet the scientific workers' needs for library service: (1) Provide for a separate library building large enough to hold all the present scientific collections of the library with room also for future growth, leaving in Washington only the economic collections, the more general reference collections, the general administrative offices, and an information service; (2) provide for central library quarters of smaller size but large enough to house the scientific collections most frequently used, leaving in Washington those that are only occasionally consulted; (3) in place of any central library quarters provide for more special library units on a bureau basis, such as the Bureau of Animal Industry library, Beltsville branch, and the other special library located at Beltsville—the Bee Investigations library, which is a branch of the Bureau of Entomology and Plant Quarantine library. There are valid arguments in support of each of these plans. Because of the rapid developments at the center and human inability to see very far into the future, it is difficult, at this time, to know the ultimate solution. More information is still needed on which to base a decision. With the cooperation of the scientific workers, valuable experience is now being accumulated that will help in reaching a decision as to the advisability of the small library-unit plan. Fortunately there will also be an opportunity in the coming year to test, to a certain extent, the second plan, as the new Administration Building now nearing completion at the center will provide 1,920 square feet of space for library purposes. As the capacity of the room is small, the collections to be filed there must be those most frequently consulted, which will require most careful selection. It may be, however, that the collection will be sufficiently large to cut down to a very considerable extent the number of books to be requested daily from Washington. With a greater improvement in the transportation and communication service to Washington, increased funds for the duplication of the most frequently used current periodicals and reference books, and increased use of microfilms, it is hoped that a fairly satisfactory library service can be provided for the Agricultural Research Center, pending the working out of the best long-range program and the making of provisions for its execution.

The library resources of Washington for the prosecution of agricultural research are most extensive, but resources alone are insufficient. They must also be made convenient for use. In view of the important place that the Agricultural Research Center occupies in the

agricultural research work of this country, it is inconceivable that provision should not be made for library facilities adequate both in availability and extent.

CENTRALIZATION OF LIBRARY ADMINISTRATION

By centralization of the library administration is meant the policy of handling the various bureau and office libraries of the Department as a single unified system instead of as separate and independent units. As a result of this policy of the library, the collections have gradually, step by step and year by year, been knit together and administered more and more as one library for the whole Department, thus insuring cooperation and continuity in the library work of the Department.

The frequent changes in the organization of the bureaus and divisions of the Department and in the location of the offices have made this centralization seem necessary and desirable. The history of the Department shows that few years have gone by that have not brought some changes in the organization. New offices and bureaus have been formed and new lines of work have been taken up. Offices have been discontinued or merged with other offices or bureaus and occasionally, though not often, certain lines of work have been dropped. The Department is not static. It is a growing, expanding organization. These changes in organization have naturally made necessary frequent adjustments in office space. Few weeks, even, have gone by in late years that have not witnessed some changes in the location of offices.

It is only natural that such changes in organization and in the location of the offices should affect the library, since there is not an office or laboratory that does not make use of the library. That these changes have led to no confusion in regard to the library collections has been due to the fact that all the branch libraries have been administered as parts of one system, with a uniform classification, making it possible, insofar as the records are concerned, to shift the collections from one place to another and to expand and contract them as the situation demands. When a bureau with a large collection of books was moved to a location in close proximity to the library, it was possible to incorporate its collections in those of the library simply by discharging the books from the bureau's accounts. Likewise, with the removal of a bureau or office to a location at some distance from the library, all that was necessary in connection with the removal of books to the new location was to charge them at the loan desk. In other words, the centralized administration of the library has made possible elasticity in the handling of the collections, an absolutely necessary condition for library efficiency in an organization such as the Department, which is constantly changing.

Other gains from the policy of centralized administration have been the building up of an approximately complete catalog in the library of all the library resources of the Department; making available all the library resources to the whole Department; improvement in the reference service; greater economy through the elimination of unnecessary duplication of books and periodicals; insurance of cooperation; and stability and continuity in the library work of the Department.

Library policies represent an earnest effort to adapt the library service to the organization and the expanding needs of the Department. The policies have, it is believed, come to be recognized as desirable simply because they have seemed to meet these needs best.

The salaries of the library staffs of the bureaus are paid from the funds of the bureaus, but the books and periodicals are purchased from the funds of the library. This form of organization has aided the development of the bureau libraries and given more opportunity for initiative on their part. While it has proved to be very flexible as far as service to the bureaus is concerned, the form of organization, as has always been realized, had in it obvious possibilities of lack of cooperation among the different units and of duplication of work. In spite of these weaknesses, the system has worked under past conditions to a somewhat surprising extent. There has been loyalty to the general library policies, and duplication has been avoided by voluntary cooperation. The degree of cooperation has varied naturally in different staffs, but has been wholly absent in none, and has been very satisfactory in most. Nevertheless, the changed conditions arising from the growth of the Department in recent years, the increase in personnel, and the consequent more frequent changes in administrative heads, made it seem both advisable and necessary as a safeguard to have all of the library work of the Department placed definitely under the direction of the librarian of the Department through an administrative ruling also requiring consultation with the librarian in connection with all library appointments. This ruling embodied in the Secretary's Memorandum No. 808, dated February 25, 1939, is an important milestone in the history of the library.

PROFESSIONAL ACTIVITIES

The meeting of the agricultural libraries section of the American Library Association in June 1939 was attended by Mildred Benton, librarian, Soil Conservation Service, Marie L. Gould and Esther D. Koch, of the Bureau of Agricultural Economics library, Melissa Speer, of the Forest Service library, and Lela E. Allred, of the main library. The librarian of the Office of Experiment Stations, Cora L. Feldkamp, was chairman of the Oberly Memorial Fund committee of the American Library Association and with Louise O. Bercaw, of the Bureau of Agricultural Economics library, continued to serve during the year on the committee on cooperative bibliographical aid of the agricultural libraries section, Miss Bercaw being chairman of the committee. The lists prepared by the committee are published in Rural America.

The librarian of the Bureau of Agricultural Economics, Mary G. Lacy, continued to serve as a member of the editorial committee and of the Federal libraries committee of the District of Columbia Library Association. She gave a short paper at the annual meeting of the Special Libraries Association in Baltimore in May 1939. At this same meeting papers were also given by Mrs. Dorothy Graf, librarian, Bureau of Chemistry and Soils, and by Mildred C. Benton, librarian, Soil Conservation Service—the former paper on the libraries of the new regional laboratories of the Department and the

latter on plans for regional libraries in the Soil Conservation Service.

The Librarian of the Department continued to serve as a member of the research board of the American Library Institute; of the board on resources of American libraries, of the Committee on International Relations, and as chairman of the subcommittee of the international relations committee on international cooperation between agricultural libraries, American Library Association; as president of the International Committee of Agricultural Librarians; and as chairman of the committee on Federal libraries, District of Columbia Library Association.

LIBRARY STAFF

In the library, 35 permanent employees were carried on the rolls at the close of the year, and 85 by the bureau and office libraries (exclusive of the staff of the Weather Bureau), a total of 120. Of this number, 16 were in administrative positions, including the librarian of the Department, the heads of divisions in the main Library, and the librarians of the bureaus; 73 were assistant librarians, junior librarians, library assistants, and junior library assistants; 5 were under library assistants, minor library assistants, and library aides; 2 were translators; 16 were clerical assistants; and 8 were messengers.

The library had the help of a number of National Youth Administration students, their work totaling, in all, approximately 3,180 hours.

FINANCES

The receipts and expenditures for the library for the fiscal years 1930–39 are shown in table 11.

In addition to ordering the books, periodicals, and newspapers paid for from the funds of the library, the library also ordered those requested for use in the work of the Agricultural Adjustment Administration, the Commodity Exchange Administration, the Soil Conservation Service, and the Solicitor's Office. The total amount of these purchases was $6,562.65.

A central record of the book and periodical purchases from any appropriation of the Department for use in Washington was made possible during the past year by Property Regulation 4114.

TABLE 11.—*Financial statement, fiscal years 1930–39*

RECEIPTS

Item	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
Source:										
Library appropriation:										
Salaries	$69,300.00	$71,860.00	$74,120.00	$74,120.00	$64,998.00	$67,613.00	$70,520.00	$70,520.00	$71,600.00	$71,600.00
General expenses	32,700.00	32,700.00	36,500.00	31,980.00	35,225.00	24,074.00	29,292.00	33,280.00	33,820.00	33,820.00
Total	102,000.00	104,560.00	110,620.00	106,100.00	100,223.00	91,687.00	99,812.00	103,800.00	105,420.00	105,420.00
Department printing and binding fund	10,614.72	13,662.86	25,207.11	19,666.69	22,993.68	17,705.97	18,033.98	23,198.78	18,847.69	21,997.88
Grand total	112,614.72	118,222.86	135,827.11	125,766.69	123,216.68	109,392.97	117,845.98	126,998.78	124,267.69	127,417.88

EXPENDITURES

Books and serials	$18,806.78	$19,971.38	$19,047.74	$13,873.16	$11,658.72	$12,714.53	$16,369.86	$17,857.92	$17,804.48	$16,483.63
Periodicals	9,431.94	9,351.98	10,402.63	9,068.76	10,259.94	10,994.21	9,956.35	10,654.63	10,757.09	11,050.72
Maps		28.50	8.43	56.30	11.81	1.50	1.68	5.25		
Index cards	149.98	227.68	299.07	188.97	167.80	130.88	136.92	120.51	122.24	129.59
Furniture, shelving, and miscellaneous equipment	1,569.37	898.32	4,019.44	2,806.80	860.65	516.46	1,623.76	1,832.10	1,790.53	2,016.98
Traveling expenses	29.64	78.87	29.63		40.38		17.50	60.20	45.50	11.14
Freight, express and trucking service	113.00	125.65	169.42	132.79	86.11	78.62	93.87	95.46	124.39	95.89
Supplies	708.47	651.73	944.77	737.62	650.31	455.48	709.94	783.55	570.80	913.59
Repairs	962.92	228.64	1,831.78	3,223.09	167.24	244.81	1,164.71	206.24	615.37	124.08
Newspapers	974.91	1,105.50	784.86	815.80	1,094.97	1,168.34	1,165.14	725.87	1,071.10	1,122.08
Telephone and telegraph				276.86	351.44	394.15	320.05	490.53	490.50	506.02
Special and miscellaneous expenses (general char service and cleaning supplies)	3,300.00	3,300.00	3,300.00	4,599.98	1,558.10					
Salaries (exclusive of char service)	65,952.43	68,365.06	69,333.05	70,173.35	59,605.36	64,982.60	68,226.79	70,347.60	71,092.18	71,552.30
Total	101,999.44	104,333.31	110,170.82	105,953.48	86,512.83	91,681.58	99,786.57	103,179.86	104,484.18	104,006.02
Printing	349.43	635.79	659.66	997.62	466.09	569.98	2,017.26	3,889.55	1,024.65	2,247.77
Binding	10,265.29	13,027.07	24,547.45	18,669.07	22,527.59	17,135.99	16,016.72	19,309.23	17,823.04	19,750.11
Grand total	112,614.16	117,996.17	135,377.93	125,620.17	109,506.51	109,387.55	117,820.55	126,378.64	123,331.87	126,003.90
Credit received for duplicates exchanged with book dealers and libraries	335.64	201.96	270.67	98.85	149.85	193.24	117.91	215.50	49.19	42.30

TABLE 11.—*Financial statement, fiscal years 1930–39*—Continued

EXPENDITURES—Continued

Item	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
Supplies:										
Cleaning and toilet	95.07	84.34	67.10	367.62	164.00	8.56	5.30	1.87	2.82	1.80
Stationery	214.74	248.22	385.71	186.64	137.16	80.30	154.61	270.33	211.73	271.89
Miscellaneous office	289.19	280.04	391.03	165.95	320.65	315.40	502.57	474.10	321.00	604.98
Binding material	109.47	39.13	100.93	17.41	28.50	51.22	46.96	37.25	35.25	34.92
Total	708.47	651.73	944.77	737.62	650.31	455.48	709.44	783.55	570.80	913.59
Repairs:										
Carpentry work	188.13	68.88	903.72	2,359.24	44.34	78.36	92.42	41.78	103.40	30.17
Electrical work	241.12	43.50	37.55	125.90	57.42	17.08	604.37	78.22	71.81	4.14
Typewriters	15.43	25.45	36.31	73.39	34.36	9.01	40.44	14.79	60.32	43.43
Painting	124.30	14.38	759.29	496.76			140.70	12.88	120.46	
Miscellaneous	393.94	76.43	94.91	167.80	31.12	140.36	286.78	58.57	259.38	46.34
Total	962.92	228.64	1,831.78	3,223.09	167.24	244.81	1,164.71	206.24	615.37	124.08

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REPORT OF THE ASSOCIATE ADMINISTRATOR OF THE AGRICULTURAL ADJUSTMENT ADMINISTRATION, IN CHARGE OF THE DIVISION OF MARKETING AND MARKETING AGREEMENTS, AND THE PRESIDENT OF THE FEDERAL SURPLUS COMMODITIES CORPORATION, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF MARKETING AND MARKETING AGREEMENTS,
FEDERAL SURPLUS COMMODITIES CORPORATION,
Washington, D. C., October 31, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith reports for the Division of Marketing and Marketing Agreements and the Federal Surplus Commodities Corporation for the fiscal year ended June 30, 1939. The reports for these two agencies, which are supervised under the direction of a single administrative official, are submitted jointly because of the very close interrelationship between their programs and activities.

Sincerely,

MILO PERKINS,
Associate Administrator,
Agricultural Adjustment Administration,
President, Federal Surplus Commodities Corporation.

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THE PLACE OF MARKETING AGREEMENT AND SURPLUS REMOVAL PROGRAMS

The marketing agreement and surplus removal programs of the Department are designed primarily to help farmers meet a basic problem with which they have contended for a long time. This is the question of getting a fair return from an agricultural commodity after it is produced.

These programs represent a direct attack upon the various marketing difficulties of farmers. They make possible more orderly selling conditions for agricultural commodities, and encourage increased distribution of crops which are produced in surplus.

The agreement and surplus removal programs serve the interests of consumers, as well as those of farmers. The stability they bring to agricultural marketing is just as important for those who consume a product as it is for those who produce it. And the surpluses which are handled by the removal programs are salvaged for the use of consumers who otherwise would not be able to get them.

SUPPLEMENT EFFORTS OF FARMERS

In recent years there has been a growing realization that programs to meet marketing problems must go hand in hand with measures to solve production problems. This fact is definitely recognized in the national farm program, of which the marketing agreement and surplus removal programs are an integral part. These measures supplement the conservation, adjustment, and ever-normal granary features of the broad program. They provide farmers with the machinery to deal more effectively with the marketing phase of their operations after crops have been produced.

The two types of marketing programs, marketing agreement and surplus removal, are closely interrelated. They seek the common goal of more efficient marketing, and they are frequently developed together. Surplus removal activities, for instance, may be planned as a direct supplement to cooperative efforts being made by growers through marketing agreement programs.

GREW OUT OF NEED

The marketing agreement and surplus removal programs grew out of agriculture's need for additional help to improve conditions under which farm products had to be sold. In their efforts to promote more orderly marketing and to protect farm income from falling to extremely low levels, farmers had already turned to group action in working out solutions. They organized cooperatives and worked with handlers of farm commodities in setting up clearing house arrangements and other mechanisms. These attempts sometimes ran into difficulties. The few who chose not to cooperate were often able to obtain the benefits without sharing in the burdens of united action, thus weakening the industry's program.

Farmers then turned to Government for aid, in their search for machinery which would lend support to their organized efforts. Today, marketing agreement and surplus removal programs are meeting this need. They are fostering cooperation among farmers and improved working relationships between producers and handlers.

The resulting adjustments are distinctly in the interests of the general welfare.

MARKETING AGREEMENT PROGRAMS

Marketing agreement programs provide for regulating the handling of agricultural commodities in interstate or foreign commerce. They are designed to encourage market stability for farm products and to promote an orderly exchange of goods. The main objectives, as stated in the declared policy of Congress, are (1) to establish returns to farmers at a level more nearly approaching the level of the prices of things farmers buy, and (2) to protect the interests of the consumer by approaching the parity level gradually and by taking no action which has for its purpose the maintenance of prices to farmers above that level.

The programs operate through marketing agreements and orders issued by the Secretary of Agriculture under a democratic procedure which requires their consideration at public hearings, and provides for referenda among producers and the assent of handlers. While marketing agreements may be used for any agricultural commodity, orders, which make the terms of the agreements applicable to all handlers, may be issued only for specific commodities. These are milk and its products, all fresh vegetables, fresh fruits (in the case of apples only those produced in Washington, Oregon, and California), olives and asparagus for canning, tobacco, pecans, walnuts, soybeans naval stores, package bees and queens, and hops.

DEALING WITH MARKETING PROBLEMS

Marketing agreement programs apply to handlers of agricultural commodities. They do not apply to farmers in their capacities as producers. In general, two methods are employed through the programs in dealing with farmers' marketing problems—one for milk and another for such commodities as fruits and vegetables.

PROVISISONS FOR DAIRY PRODUCTS

For milk, the programs establish minimum prices which handlers in a marketing area are required to pay producers, and, in addition, provide for a method through which payments are made. Through these programs it has been possible to bring greater stability to a number of milk markets, improve competitive relationships among handlers, and provide for more equitable treatment for producers in the sale of their milk and in the returns they receive.

PROVISIONS FOR CROPS

The programs for commodities in the fruit and vegetable field in the main provide for the regulation of shipments out of a producing area on the basis of volume or the grades and sizes of the commodity which may be shipped. The volume of shipments of a farm crop may be regulated under a marketing agreement program so as to supply the market with all it can take without seriously depressing returns to growers. In thus preventing gluts, speculative risks resulting from long-distance shipping and high handling charges are minimized. During seasons when a crop may be short, volume regu-

lation of shipments may be used to help the industry spread the marketing of the total supply over the entire normal shipping period. Thus, both in times of heavy production and also in times of light production, marketing agreement programs provide the means for equitable participation by all growers in the more orderly distribution of their products.

Regulating the grades and sizes of a commodity shipped helps to adjust market supplies more nearly in keeping with demand conditions for particular grades or sizes. By keeping off the markets low-grade and heavily discounted sizes of a product, growers are frequently able to prevent direct cash losses. At the same time, they are given a better opportunity to sell those grades and sizes of the product which are more in demand by consumers.

SCOPE OF OPERATION

During the last fiscal year, more than 40 marketing agreement programs were in effect for milk and dairy products and for other farm products such as fruits, vegetables, nuts, and hops. Approximately 1,300,000 producers were directly affected through the operation of these programs.

Since marketing agreement programs were first made available in 1933, much has been learned concerning the possibilities and limitations of this new approach to the marketing problems of farmers. The policies which are being followed in the development and operation of these programs have grown out of practical operating experience. The programs are now emerging from the experimental phase and are taking their place as permanent machinery available to agriculture in dealing with certain parts of the complicated marketing problem. The sizable store of information and experience which has been acquired is being used constantly further to improve this democratic means for the three-way cooperation of farmers, handlers, and Government.

SURPLUS REMOVAL ACTIVITIES

Surplus removal programs frequently supplement the efforts which an industry makes under a marketing agreement program, or through other means, to improve selling conditions. The immediate objective is to help farmers deal more effectively with burdensome, price-depressing surpluses which glut their markets. The broader objective is to widen outlets for farmers and to stimulate the use by consumers of needed supplies of farm commodities.

TYPES OF PROGRAMS

Three types of surplus removal programs are employed in carrying out these general objectives. They are: (1) Programs to encourage increased domestic distribution and consumption, (2) domestic diversion and new use programs, and (3) export subsidy programs. All of these are designed to assist farmers in moving surplus supplies of agricultural commodities which otherwise would seriously depress prices.

INCREASING CONSUMPTION

The programs to encourage increased domestic distribution and consumption are designed primarily to bridge the gap between the surpluses on farms and the lack of adequate food supplies among millions of the Nation's consumers. The most significant development in this field of activity during the last year was the inauguration of the surplus food order stamp plan. Under the stamp plan, increased buying power is given to needy low-income families for use in purchasing commodities officially listed as being "in surplus." This plan utilizes the normal channels of trade in getting the surplus commodities from the farmer to the families who need them.

The stamp plan was developed in the search for a more effective means of encouraging the consumption of surplus commodities. Previously, the principal method used to secure this increased consumption was the purchase of surpluses by the Federal Surplus Commodities Corporation and their direct distribution to the needy and unemployed through State welfare agencies. While the direct purchase and distribution activities are being continued, experimental operation of the stamp plan during the last weeks of the fiscal year proved encouraging enough to warrant a gradual expansion of this new method for handling surplus commodities. In the cities where the stamp plan is put into effect, the direct distribution of surplus products by welfare agencies is discontinued.

ENCOURAGING WIDER USES

The diversion and new use programs seek to develop and encourage future domestic outlets and new uses for farm products. Certain agricultural commodities produced in surplus quantities have been sold in very limited amounts or not at all in parts of the United States. Under a diversion program, provision may be made for payments to producers for the sale of surplus commodities in new domestic markets. The purpose of the payment is to equalize the returns from sales in the new outlets with those realized from sales in normal markets. In this way, new markets may be developed. The diversion programs operate through agreements between the Secretary of Agriculture and organizations, usually organized for the purpose by the various industries.

Under these programs, surpluses of agricultural commodities may also be diverted from normal channels of trade in efforts to expand the production of byproducts and to develop new uses. Usually the lower qualities of a commodity are used for byproduct purposes. The expansion of this form of diversion is carried out through payments to growers. The elimination of supplies of lower grades from direct competition with the better-quality products, particularly when a surplus exists, removes the price-depressing effect which the low-quality stock tends to exert on the entire production. At the same time the use of surpluses in byproduct channels is fostered.

New uses for surplus agricultural commodities are sought largely by making available to certain public institutions supplies which may be used for experimental purposes. Through such a program the use of cotton, for example, is being tested in the construction of highways

and airplane runways, as a lining for drainage ditches, in the building of small shelters and houses, and in many other "new use" projects.

EXPORT PROGRAMS

The export programs are designed to encourage sales of certain surplus commodities in foreign countries. During the last fiscal year, a wheat export program helped United States producers in holding their fair share of the world markets. Out of a total of 118,000,000 bushels of United States wheat and wheat in the form of flour sold to foreign countries, the exportation of approximately 94,000,000 bushels was assisted directly by the export program. Plans for an export program to help United States cotton producers maintain their fair share of the world cotton market were developed to operate during the 1940 fiscal year.

AID THROUGH LOANS

As a further aid to farmers in dealing with the problem of agricultural surpluses, loans may be made on commodities adapted to storage. The loans, while made by the Commodity Credit Corporation, are often employed to supplement operations under marketing agreement and surplus removal programs. Through these loans, producers are able to keep off the markets supplies of commodities which otherwise would prove burdensome and price depressing. The loans for some types of commodities also eliminate the pressure of selling, particularly during the harvest period. Loans are made also to provide advances to growers on commodities to be diverted to new or byproduct uses and for which payments are to be made under diversion programs. Such loans are of the nonrecourse type and are made to a cooperative organization whose principal function is to handle operations under the program. The cooperative organization advances the loan funds to the grower upon receipt of the commodity for diversion.

ADMINISTRATIVE AGENCIES

Marketing-agreement and most of the surplus removal programs are developed in the Division of Marketing and Marketing Agreements. Many of the surplus-removal programs, particularly those designed to encourage increased domestic distribution and consumption, and certain types of export programs are carried out by the Federal Surplus Commodities Corporation.

FUNCTIONS AND ACTIVITIES OF EACH

The major functions of the Division in developing and administering marketing-agreement programs and in working out plans for dealing with farm surpluses are carried out through the Dairy Section, the General Crops Section, the Marketing Section, and the Poultry Section. In addition, there are the Field Investigation Section and the Transportation Section. The Field Investigation Section is responsible for auditing and for investigational work to facilitate administration and operation of programs. The Transportation Section was established during the last fiscal year to deal with problems relating to the adjustment of agricultural freight rates.

The activities of the Corporation are carried out primarily through two main units. The Purchase and Distribution Division is responsible for buying surplus commodities, in accordance with the programs which have been developed, and their distribution to State welfare agencies for the use of needy families and to make possible free school lunches for underprivileged children. The Stamp Plan Division is responsible for operations under the surplus food order stamp plan in the areas where it is put into effect.

The functions of the Division of Marketing and Marketing Agreements and the activities of the Federal Surplus Commodities Corporation are closely interrelated. Both are concerned with action programs which seek primarily to improve marketing conditions for farmers. In order to carry out their work most effectively, each must of necessity follow policies which are consistent with those of the other agency.

THE BASIS FOR MARKETING-AGREEMENT PROGRAMS

Marketing-agreement programs, first available in 1933 under the Agricultural Adjustment Act, are now provided by the Agricultural Marketing Agreement Act of 1937. Some of the objectives originally sought by the advocates of marketing-agreement legislation of necessity have had to be modified in line with experience in operating the programs.

OBJECTIVES SOUGHT

At first, the idea behind marketing-agreement programs was that they might be used in some manner as an alternative approach to the production-adjustment features of the Adjustment Act. Gradually, a clearer concept was developed of the role which could be played by these programs. Industry groups discovered that these programs could provide the legal basis for voluntary industry efforts to exercise a reasonable degree of control over market supplies and prices. Cooperatives saw in marketing-agreement programs an opportunity to make group action more effective through an extension of the principles of cooperation. These programs, it was felt, could provide a capstone to the agricultural cooperative movement. Others saw in the marketing-agreement programs an opportunity for encouraging closer working relationships between farmers and those who handle their products.

EARLY LEGISLATION

The Agricultural Adjustment Act of 1933 contained only four general paragraphs of provision for marketing-agreement programs. The Secretary of Agriculture was authorized to enter into marketing agreements with processors, associations of producers, and others engaged in the handling in the current of interstate or foreign commerce of any agricultural commodity or product. Provision was made for the issuance by the Secretary of licenses which required all handlers to comply with their provisions. The Adjustment Act, however, provided for only such regulation through licenses as might be necessary to eliminate unfair practices or charges. Provisions giving the details, or even the general scope, of a marketing program were lacking.

AMENDED IN 1935

It was not long, therefore, before question arose concerning the constitutionality of the rather comprehensive programs developed under the marketing agreement and license provisions of the original act. Enforcement in the courts became difficult. When the National Industrial Recovery Act was declared unconstitutional by the Supreme Court, Congress in 1935 amended the marketing-agreement provisions of the Agricultural Adjustment Act to remove certain features which were thought to be objectionable.

The 1935 amendments to the marketing-agreement provisions of the act were very extensive. These amendments continued in effect the then existing marketing agreements and licenses; but, in addition to continuing the Secretary's authority to enter into marketing agreements, provided for the issuance of orders instead of licenses in the future. It was required that an order regulate the handling of a commodity in the same manner as a marketing agreement. Before an order could be issued, the Secretary was required to determine whether it was approved by at least two-thirds of the producers, by number or by volume of the commodity involved. An order could be issued with a marketing agreement if it had the required producer approval and the agreement was signed by handlers of at least 50 percent of the volume of the commodity. If the required handler signature to an agreement could not be obtained, but the issuance of the order had the necessary producer approval, then the order could be issued without an agreement if the action had the approval of the President.

ORDERS FOR SPECIFIC COMMODITIES

The issuance of orders was limited to specified agricultural commodities. In addition to milk and its products, orders could be made applicable to all fruits other than apples, and all vegetables for fresh consumption, olives and asparagus for canning, nuts, tobacco, soybeans, and naval stores. By subsequent amendments, hops, package bees and queens, and apples produced in Washington, Oregon, and Idaho have been added. Provisions which could be incorporated in orders to regulate the handling of the listed products were definitely spelled out. Authorization was also given the Secretary for the selection of industry committees or agencies to assist in the administration of marketing agreements and orders.

MORE RECOGNITION TO PRODUCERS

Of special significance to producers and their cooperatives is the fact that the enactment of the 1935 amendments gave them a more definite place in the development and operation of marketing-agreement programs. The Secretary of Agriculture now had to determine whether producers favored the issuance of an order, and no order could go into effect without the required producer approval. The provisions which were incorporated to strengthen the position of producers and their organizations resulted in an important change in the administrative procedure which governed the development of marketing-agreement programs. Producers and their representatives

were given more incentive to help shape the programs, as well as greater responsibility in their administration.

Shortly after Congress had sought to clear away the constitutional questions raised by the Supreme Court's decision on the National Recovery Act, the marketing agreement programs were again involved in new legal difficulties. These arose after the January 6, 1936, decision of the Supreme Court against the production control and processing-tax features of the Agricultural Adjustment Act. Several of the lower district courts differed as to the separability of the marketing-agreement provisions from the production control features which had been declared unconstitutional.

THE MARKETING AGREEMENT ACT

In order to clarify further the legal status of marketing agreement programs, Congress passed the Agricultural Marketing Agreement Act of 1937. The Marketing Agreement Act reenacted, amended, and supplemented the marketing agreement provisions of the Agricultural Adjustment Act, as amended in 1935. The purpose of the act, as set forth in the declaration of policy, was to establish and maintain such orderly marketing conditions for agricultural commodities in interstate commerce as would establish prices to farmers at a level that would give agricultural commodities a purchasing power, with respect to articles that farmers buy, equivalent to the purchasing power of agricultural commodities in the base period. The act enabled the Secretary to conduct a referendum among producers for the purpose of ascertaining whether issuance of an order was approved by them. Otherwise, the provisions of the Marketing Agreement Act of 1937 were much the same as the marketing agreement provisions of the Agricultural Adjustment Act as it was amended in 1935.

ENFORCING THE PROGRAMS

Much progress has been made in the enforcement of marketing agreement programs during the last 6 years. The modifications made by Congress since the original provisions for these programs were enacted have strengthened their legal basis. Today there exists a backlog of legal precedent which makes possible more expeditious handling of enforcement cases through the courts.

The enforcement of marketing agreements and licenses under the 1933 Adjustment Act was difficult. The reasons for this difficulty are evident in the various court decisions which led to the enactment of amending legislation. The changes which were made by Congress in the 1935 amendments opened the way to more effective enforcement. This was particularly true for marketing-agreement programs in the fruit and vegetable field. However, the efforts to enforce programs for milk continued to be subjected to long, drawn-out procedures, with costly delays to producers.

Enactment of the Agricultural Marketing Agreement Act of 1937 helped to overcome many of the difficulties experienced in connection with the enforcement of the programs for milk. It also helped further to expedite the enforcement of the programs for other commodities.

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SUPREME COURT DECISIONS

Since the Marketing Agreement Act was passed, the enforcement of marketing agreement programs has been supported by the courts, either by rulings of lower courts or through appeals to higher courts.

The most significant legal development, insofar as the Marketing Agreement Act is concerned, took place June 5, 1939, when the Supreme Court rendered its decisions on the New York and Boston milk order cases. These decisions upheld the validity of the programs in the two markets and confirmed the constitutionality of the Marketing Agreement Act, under which the orders were issued.

EFFECT OF THE BOSTON RULING

The decision in the Boston case marked the high point of an almost continuous legal struggle since the Federal milk marketing program first became effective for that market late in 1933. In addition to settling major legal questions, the decision freed for payment to producers nearly $3,000,000 which had been impounded by a lower court pending the milk handlers' appeal to the Supreme Court. The money represented payments due from handlers to producers through the equalization pool for the Boston milk market under the order. Had the Supreme Court ruled against the program, the money would have reverted back to the handlers instead of being paid out to producers. The funds, accumulated during a period of 17½ months, represented an increase in producers' returns of slightly over 20 cents per hundredweight of milk delivered during that period, or an average total additional payment to individual producers of about $190. Milk for the Boston market is produced by approximately 18,000 producers in the States of Vermont, New Hampshire, Maine, New York, Massachusetts, and Rhode Island.

EFFECT OF THE NEW YORK RULING

The decision of the Supreme Court in the New York case restored to producers a program for what is commonly regarded as the world's largest fluid milk market. Almost 65,000 producers in 6 States produce, for this market, milk which has a farm value of around $100,000,000 a year. The program for the metropolitan New York milk marketing area operates under complementary Federal and State orders which first became effective September 1, 1938. Efforts to enforce the program against noncomplying handlers resulted in an adverse lower court decision and the suspension of the program as of February 1, 1939. The decision of this lower court was appealed directly to the Supreme Court. During the period in which the appeal was pending, extremely chaotic conditions developed in the New York milk market. As a result, large numbers of producers received for milk sold for fluid purposes less than its value for manufacturing uses. The Supreme Court's reversal of the lower court's decision made it possible to reinstate the market-wide machinery under which orderly selling conditions had been enjoyed by dairy farmers in the States of New York, Pennsylvania, New Jersey, Connecticut, Massachusetts, and Vermont who produce milk for the metropolitan New York area.

LEGAL ISSUES CLARIFIED

The decisions of the Supreme Court in the Boston and New York cases definitely clarified some of the broader legal issues and gave sanction to the general principles of Federal milk market regulation. While the security of marketing agreement programs, especially those for milk, is firmly founded by these decisions, there are numerous legal questions which remain to be settled. In general, the courts have assumed an understanding attitude toward marketing agreement programs and have recognized the nature of the problem which is involved in their administration and operation.

ENFORCEMENT POLICY

The Department of Agriculture is charged with the responsibility of seeing that the terms and conditions of a marketing agreement and order, once put into effect, are complied with. This calls for a vigorous enforcement policy, and such is being followed. The Department of Justice is doing its part in litigation to make this enforcement policy effective.

SIGNIFICANCE OF THE DECISIONS

The two decisions of the Supreme Court on the milk marketing programs are of far-reaching significance to the dairy industry and to the agricultural cooperative movement in general. They give greater permanency to an approach to marketing problems which farmers have sought through both the Federal and State Governments.

During the last half dozen years many States have enacted legislation which provides for programs similar to the Federal marketing agreement programs. Nearly half the States of the country have milk-control laws, and several States have laws for the development of marketing programs for other farm commodities, particularly fruits and vegetables.

FEDERAL-STATE COOPERATION

The Marketing Agreement Act authorizes Federal-State cooperation in the development and administration of programs regulating the handling of agricultural commodities. Such arrangements for milk and for certain fruits and vegetables have been worked out between the Federal Government and seven States. Closer coordination between the activities of State and Federal Government agencies in dealing with producers' marketing problems is becoming evident. The Supreme Court's decisions in the New York and Boston milk cases and earlier decisions on State regulatory activities make available, for the first time, fundamental legal guides for this type of Federal-State cooperation.

THE DAIRY MARKETING AGREEMENT PROGRAMS

During the fiscal year 27 marketing agreement programs were in effect in the dairy industry. Of this total, 25 provided for the regulation of the handling of milk in fluid milk markets, 1 was for the

national evaporated milk industry, and the other for the national dry skim milk industry. The programs were in effect through marketing agreements with and without orders, through orders alone, and through licenses which had been issued before enactment of the Agricultural Marketing Agreement Act of 1937. Altogether, the programs directly affected approximately 1,200,000 dairy farmers. The annual farm value of fluid milk alone sold under the marketing agreement programs exceeds $149,000,000.

TABLE 1.—*Estimated number of producers and estimated volume and value of milk used in markets under marketing agreement programs, July 1938–June 1939*

Market	Producers	Estimated total volume	Estimated total value
	Number	*Pounds*	
Battle Creek [1]	281	22,252,834	$411,462.00
Boston [2 3]	[4] 17,180	718,901,891	12,928,483.52
Cincinnati [5]	4,633	216,851,566	4,463,894.73
Denver [1]	1,915	[6] 152,005,229	2,174,605.43
Dubuque [5]	253	20,199,692	307,431.67
Fall River [5]	358	34,736,085	1,047,155.57
Fort Wayne [7]	1,095	45,979,103	798,115.13
Kalamazoo [1]	376	30,536,678	544,415.18
Kansas City, Mo. [8]	1,532	128,325,285	2,508,397.98
La Porte County [5]	292	15,799,536	231,023.32
Leavenworth [1]	89	[6] 9,144,491	150,902.87
Lincoln [1]	1,075	[6] 83,652,492	1,023,746.70
Louisville [1]	1,470	134,389,696	2,449,149.40
Lowell-Lawrence [2 3]	[8] 792	52,770,312	1,583,300.92
New Bedford [1]	337	36,879,907	1,174,180.81
New York [5]	63,396	4,684,908,000	96,605,000.16
Omaha-Council Bluffs [9]	2,485	101,602,672	1,677,152.31
Quad Cities [1]	1,185	76,002,036	1,155,234.97
St. Louis [5]	4,969	328,116,956	5,853,410.91
San Diego [1]	145	[6] 85,946,828	1,851,288.56
Sioux City [1]	1,105	43,552,089	672,909.92
Toledo [5]	2,469	136,769,424	2,463,578.04
Topeka [10]	225	[6] 22,602,860	348,775.14
Twin Cities [1]	6,336	459,893,693	6,546,083.59
Wichita [1]	430	[6] 46,599,843	787,503.76
Total	[11] 114,423	7,688,424,203	149,862,202.59

[1] License in effect.
[2] Marketing agreement and order in effect.
[3] Volume and value of milk pooled.
[4] Period January–July 1936.
[5] Order in effect.
[6] Reported in butterfat and converted to milk equivalent.
[7] Marketing agreement to Oct. 14, 1938; order beginning Oct. 15, 1938.
[8] Number of producers estimated by Massachusetts Milk Control Board in 1937.
[9] License to Apr. 4, 1939; order beginning Apr. 5, 1939.
[10] Marketing agreement in effect.
[11] In addition, approximately 118,000 producers are affected by the marketing agreement program for the evaporated milk industry, and approximately 1,000,000 producers by the program for the dry skim milk industry.

VARIED ACTIVITIES

Plans for further expansion of the programs for fluid milk were under way at the close of the fiscal year. Among the markets in which preliminary steps had been taken before putting programs into effect were Chicago and New Orleans.

Activities in connection with dairy marketing programs during the course of the fiscal year included the supervision of existing programs, consideration of proposals to amend or institute programs, analysis of supply and demand conditions affecting the marketing of milk and milk products in various markets, analysis of economic problems arising from the operation of the regulatory programs for milk, cooperation with State authorities in the formulation of con-

current and complementary marketing agreements and orders, analysis and supervision of programs designed to stabilize markets by surplus removal and by relief distribution of milk or milk products, and cooperation with other Federal agencies and with producer and handler groups in the formulation and administration of a general stabilization program for dairy products.

WHAT THE PROGRAMS DO

In general, the milk marketing agreements, orders, and licenses provide for an agency to administer the terms of the program, define the marketing area to which the regulation applies, and establish a method for fixing minimum prices of milk according to use and a method for distributing returns to producers. Returns to producers may be distributed through either an individual-handler or a market-wide pool. If an individual-handler pool is stipulated, the prices received by producers delivering milk to any one handler will be uniform, but they may be different from those received by producers delivering milk to other handlers, depending upon differences in the utilization of milk by the various handlers. If provision is made for a market-wide pool, all producers will receive a uniform price no matter to which handler the milk is delivered. Some form of base rating may also be used in the distribution of returns to producers in connection with either type of pooling arrangement.

In some of the milk marketing agreement programs, provision is made for a special producer price for milk disposed of under any program which may be approved by the Secretary for the sale or disposition of milk to low-income consumers, including persons on relief. This is done in markets where, through the cooperation of municipal authorities and industry groups, there is an opportunity to put into effect a program for supplying needy families with more milk at less than the regular retail price. The objective of such a program is to encourage increased milk consumption among people not now getting adequate supplies, and at the same time to improve the total returns of producers by utilizing quantities of milk which otherwise would be used for manufacturing purposes.

SOME ECONOMIC CONSIDERATIONS

In a regulatory program, the primary purpose of which is the fixing of prices, one of the most difficult problems is to ascertain and maintain sound price relationships. This is especially true in the fixing of prices in fluid markets, where several prices for the same product may be necessary in order to handle adequately the pricing problem. Unless sound price relationships are maintained, forces may be set in motion which may eventually result in the breakdown of the program. The structure of prices incorporated in any milk regulatory program is the result of the interpretation of the facts in the record of a public hearing at which producers, handlers, and others were afforded an opportunity to provide pertinent statistical and other information.

The maintenance of sound price structures becomes much more complicated in alternate periods of light and heavy production of milk and dairy products. Every effort is being made to improve and work

out methods of administrative procedure so that rapidly changing conditions in milk markets where programs are in effect may be met promptly.

IMMEDIATE VERSUS LONG-TIME OBJECTIVES

An important immediate objective of regulation in some markets is to bring about a degree of stability in the marketing processes. In many instances, this objective requires the maintenance for short periods of certain elements of status quo. Frequently, the maintenance of status quo necessitates some compromise with the longer time adjustments which are needed for the most economic organization of the marketing structure.

One problem of this nature is related to maintaining historical relationships among various groups of producers serving a market. Prior to the institution of a regulatory program, it is often found that some producers or some groups of producers are able to secure a marketing or price advantage which they do not share with other producers. Sometimes this advantage depends upon their location in relation to the market, or upon the quality of the milk they produce, or upon other similar factors. The question is raised, when the regulatory program is being devised, as to the degree to which such producers should be allowed to maintain their advantage, and to what degree they should be required to share it with other producers in the market.

MEETING A SITUATION

Since the immediate objective in putting a regulatory program into effect usually is to restore stabilized conditions, it frequently is necessary to preserve certain advantages which some producers in the market enjoy over others. This is done with the realization that when stability is restored, it will be possible to begin revising the program to provide eventually for greater equity among producers.

A typical situation of this kind is found in connection with the use of the so-called "nearby differential" which is included in some programs for the very large milk markets. When handlers have had to draw additional supplies of milk from producing areas located at great distances from the market, frequently producers nearest to the market have been left with a substantial premium for their milk which cannot be accounted for by actual transportation costs alone. In the development of a program, these nearby producers have tended to insist that the full amount of this premium be preserved in their returns despite the fact that the market would, for the first time, have a bottom placed under the whole price structure because of the program. The "nearby differential" has been used to meet such a situation, with the expectation that gradual adjustments will be made later on the basis of practical operating experience under the program in the market.

OPERATING PROBLEMS ENCOUNTERED

Rapidly changing economic conditions invariably put a strain on a regulatory program, which by its very nature is somewhat cumbersome and inelastic. Changing conditions raise problems with respect to the maintenance of sound price relationships, and they also affect other provisions of a regulatory program under an order. When

a market has a scarcity of milk and it is necessary for handlers to go outside of the usual milkshed in order to secure additional supplies, questions are frequently raised regarding the payment for this under the order, the application of transportation differentials and allowances, and many others of a similar nature. When the market is characterized by large surpluses, ways and means must be found under the regulations for handling such surpluses. Again problems are raised concerning handling and manufacturing allowances, as well as adjustments in the price structure.

The classification of milk for the purpose of pricing frequently poses difficult questions. These are especially acute when the market structure is in a state of transition as a result of changing health ordinances. When health ordinances in a marketing area become more stringent, these changes must be reflected in a changed price structure, and this in turn requires new methods of classifying milk. Where more than one quality of milk is being sold in a marketing area because complete adjustment has not been made to a more stringent health ordinance, the problem of classification is especially difficult. Even after a complete health ordinance adjustment has been made, market practice frequently inhibits making more satisfactory adjustments in the system of classification.

NEED FOR FURTHER STUDIES

Effort is being directed continually toward drafting programs in such a manner that changed conditions in a market can be handled without the necessity for frequent changes in the order which is the instrument of regulation.

The practice is to subject all such economic problems to analysis as soon as they are discovered or anticipated, in order to determine what adaptations should be made in the programs.

The problems that arise in connection with the operation of dairy marketing agreement programs are due to various causes. Some are due to the lack of complete understanding of the purposes of such a regulatory program in a market and of the statutory limitations which apply to the provisions and the administrative procedures. Other problems, essentially legal and economic in nature, are not to be solved easily, since the legal questions involved are frequently without precedent and since many of the economic questions have been the object of little or no research.

Each market in which a fluid-milk program is in effect offers its own peculiar problems, but many are common to several markets. These may be roughly divided into two groups. One group is made up of those problems arising from the method and procedure of initiating and administering an order in a fluid-milk market. The other group is composed of those problems arising from customary marketing processes that are to be recognized in the promulgation of an agreement or order.

PROCEDURE FOR DEVELOPING PROGRAMS

The usual procedure for initiating a marketing agreement program in a market is through requests from the market. This may be made by producers and handlers, but, in most instances, the request for a

program and for its consideration at a public hearing comes from producers' cooperatives. Once a hearing is called, it is the responsibility of producers, handlers, and others in the market to supply the testimony and evidence necessary as the basis for further action. Each provision of a proposed marketing agreement and order must be justified. The hearing affords all interested parties an opportunity to take part in the development of a program with sound and workable provisions for the particular market. Frequently producers do not have the necessary factual information with which to justify their proposal. Handlers, on the other hand, do have this information. Too often, however, they have been unwilling to cooperate by taking part in the hearing and furnishing the facts for the record. Since handlers are the ones who are subject to regulation under a marketing agreement program, the submission of pertinent data by them to show the extent to which they would be helped or injured by each specific provision of a proposal certainly is in their own interests.

AMENDING A PROGRAM

Amendments to marketing agreements and orders are issued through the same procedure as are the orders themselves. The minimum length of time required, from the receipt of a petition for a hearing on an amendment to the effective date of such an amendment, is approximately five weeks, although no amendment has actually become effective in so short a time. If there is a change in the production conditions of certain supply areas, an immediate increase in price may be advisable. By the time an amendment to the order can be made effective, however, the situation may have become modified to the extent that another course of action may be more desirable.

RESPONSIBILITIES IN PRICING MILK

Price decreases, as well as price increases, are desirable and necessary at certain times. Because, as a matter of policy, each order or amendment must receive the approval of producers before it may become effective, it has been difficult to amend an order with the objective of decreasing prices, although such price change may have been in the best interest of the producers as a group. Producers' cooperatives or individual producers will seldom petition that the price of their milk be reduced. The producer himself finds it to his individual advantage to maintain a higher price for his milk, in spite of the fact that all producers together may benefit in the longer run if the price is reduced. Attempts have been made to handle this problem through the use of price formulas which provide for automatic adjustments in prices as conditions change. Formulas have not been entirely successful in this regard, however, because it is quite impossible to include in a formula all of the elements which might have considerable effect on the price.

So far the problem of reducing prices in marketing agreement programs has not been acute because, for the most part, it has been necessary to raise prices. However, the time may come when it may be necessary to make general reductions in prices in all markets. If price decreases do become necessary in a market, but producers refuse to approve them, the only possible action would be for the Secretary to suspend or terminate the order which provides for the regulation.

Such action, although necessary, would be wasteful in the extreme. Much of the work already done at great public expense in providing stability for such a market would be lost, because, in order for the program to work efficiently and in the longer time public interest, it must be continuous.

MARKET CUSTOMS

The second group of problems, in general, concerns the marketing customs in the market. The solution of many of these problems varies from market to market and must be based on the peculiarities and customary practices of the market. In each marketing agreement and order, it is necessary to define the marketing area and to designate the producers and handlers that are to be affected by the provisions of the regulation. In relatively few markets can the marketing area be defined as the area within the corporate limits of a city. This area is generally composed of a city and its suburbs or its satellite towns and villages. An attempt is made to define the marketing area in such a way as to include most of the sales of the handlers operating in the market. Some handlers usually distribute milk throughout a metropolitan area without regard to the fact that such distribution may go beyond the corporate limits of the principal city.

THE MARKETING AREA

Complications in pricing milk are introduced if all parts of the marketing area do not have similar sanitation regulations covering the production, processing, and distribution of milk. It costs less in general to produce milk for a suburban community that has less stringent sanitation regulations than for an urban center that has more stringent regulations. If the suburban area is included in the marketing area and producers deliver milk to a handler who sells milk only in the suburb, they receive the same price for their milk as producers delivering a superior quality and presumably more costly milk to an urban handler. On the other hand, if the suburb is not included in the marketing area and if a considerable amount of milk is sold by urban handlers in the suburb, the determination of the volume of and the pricing of such out-of-market sales become important matters. It is extremely difficult to determine the volume of such sales outside of the marketing area if they are made on a continuation of urban routes. Such milk must be priced so that it meets the competition of the inferior suburban milk. Frequently, it is not easy to determine at what price such suburban milk is purchased from producers. A somewhat similar problem is posed in the definition of producers who are to be affected by the order.

THE PRODUCER DEFINITION

The definition of a milk producer under regulatory programs frequently raises important questions. This is especially so in markets where the health ordinances are ambiguous with respect to the quality of the milk which may be sold, or where the ordinances are not stringently enforced. The Marketing Agreement Act provides that nothing in an order or agreement shall prohibit the sale, in any marketing area, of milk or milk products produced anywhere in the

United States. The policy, therefore, has been to place all milk sold or qualified for sale as milk in a defined marketing area under the regulation.

In some instances, because the health ordinance is ambiguous or not enforced stringently, it has been difficult to distinguish between producers who were producing fluid milk from those producing manufactured milk. This problem arises in connection with handlers who are engaged in both the distribution of fluid milk and the manufacture of milk products. If the health ordinance does not clearly segregate the fluid milk producers from the manufactured milk producers, the handler may claim that the milk of all of his producers must be considered as comprising his fluid milk supply. Such a situation tends to reduce the protection which is supposed to be afforded fluid milk producers, and to a degree mitigates the effect of the regulation on the handler.

COMPLICATIONS IN POOLING

This problem becomes especially acute in connection with market-wide pools. Under such pools, no matter how many manufactured-milk producers a handler is successful in having included in the pool, the price which that handler is able to pay producers is the same as that paid by any other handler. In such a situation, the level of prices to all producers is lowered, but the price paid by the handler engaged in "diluting" the pool does not suffer in relation to the prices paid by other handlers. Under an individual-handler pool, of course, only the price paid by the handler engaged in the "diluting" process is reduced, and competition among handlers for milk supplies probably tends to set a limit to the extent to which one handler can engage in this practice.

The question as to the type of pool to be used in the market is always of large importance. Generally, it may be conceded that the market-wide pool is the pool that should be included in all orders, since it provides that all producers be paid a uniform price for milk, and that the individual-handler pool is desirable only insofar as its operation tends to have the effect of the market-wide pool. The individual-handler pool does make it possible for different producers to receive different prices for their milk. In many markets it is difficult to obtain the necessary information for determining which of these two types of pools should be used. In such cases market practices and preference, as shown by the hearing record, are usually the deciding factors.

CLASSIFYING MILK

The proper classification of milk in a market is always a problem in connection with correct pricing. The number of classes of milk varies from market to market. In Boston, there are as few as two classes, and in New York City there are as many as nine classes. The number of classes of milk in a market is determined in part by the organization of the market, in part by the sanitation regulations affecting the sale of the several milk products, and in part by the volume of milk shipped to market relative to that used for fluid purposes.

In general, the larger the market and the more complex its marketing processes, the more intricate and more thorough are the sanitation regulations. Also, the larger the supply is relative to fluid milk sales, the greater the number of classes that will be necessary to handle adequately the pricing problem. There are advantages to producers in having a larger number of classes if the supply of milk is relatively large and the sanitation regulations are stringent on some of the manufactured dairy products. A large number of classes permits a fine stratification of demand, but disadvantages arise from the complexity of bookkeeping and verification of records that is necessary in such instances.

THE PRODUCER-HANDLER

One of the more difficult questions involves the relationship of the producer-handlers to the marketing-agreement program for a market. The question is partially economic and partially administrative. The most important decision to be made in regard to producer-handlers is whether they should be included in market-wide pools. Producer-handlers as a rule have a very high percentage of class-1, or fluid-milk sales. It is contended that producer-handlers contribute little to the seasonal surpluses of a market because they regulate their production to conform to the seasonal variation of their fluid-milk sales. Therefore, it is maintained, they should not be forced to bear any of the burden of the seasonal surplus and should be exempted from the pool.

On the other hand, it may be said that the milk of a producer-handler is of the same value as that of any other producer before its sale to a handler. It meets the same sanitation regulations, and customary market differentials could be paid for any differences in butterfat content, for any other physical differences in the milk, and for differences in advantage of location, just as with the milk of other producers. Since the milk of producer-handlers and other producers is comparable, it would seem that the prices received for the production of both should be the same. If the producer-handler is exempt from the pool, his blend price will generally be higher than that of other producers. It would seem that on theoretical considerations the weight of the evidence is for including the producer-handler in the pool.

PARTLY EXEMPT

However, certain difficulties are encountered in including producer-handlers in a market pool. In general, producer-handlers would be required to make payments to the market pool because of their greater-than-average proportion of fluid-milk sales. Where a producer-handler purchases no milk from other producers it is difficult to explain to him the equity of an arrangement which does not permit him to retain the total proceeds of the sale of his own production. The cost of litigation to collect from producer-handlers payments due to the market pool and the cost of verifying their sales records more than likely would exceed their pool payments.

As a practical solution, producer-handlers under marketing agreement programs are required to make reports as are all other handlers,

and if, in addition to the milk produced by them, they buy from other producers, they must settle for that milk bought on the same basis as any other handler subject to slightly varying requirements as to allocation of utilization between produced milk and purchased milk.

INDUSTRY-GOVERNMENT RELATIONSHIPS

The development of sound regulatory programs requires the cooperation of all interested groups. This cooperation is sought in the formulation of a proposed program, in the public hearings required before the program can go into effect, and in getting compliance with the provisions of the program after it has been made effective.

THE ROLE OF PRODUCERS

Because of the nature and the basic purposes of the Marketing Agreement Act, organized producers in a given market have the responsibility for first proposing that a program be instituted. This entails a further responsibility to formulate a definite proposal for the type of program which they believe would best carry out the purposes of the act in the market. This proposal provides a tangible basis for discussion at a public hearing, without in any way committing the Government in its favor. The producers' organization, as sponsor, is expected to prepare and present at the hearing supporting evidence on the need for regulation and the merits of its proposal. Other producers in the market, either organized or unorganized, are expected to present evidence as to how the various provisions of the proposal might affect them. While it is not expected that individual producers will be able to prepare lengthy and well-documented testimony, every effort is made to conduct the hearings in such a way as to encourage any person with an interest in the proceedings to testify in his own way as to just how he will be affected by any provisions of the proposal.

RESPONSIBILITY OF HANDLERS

The full participation of handlers as well as producers is vital to the formulation of a regulatory program. The interest of handlers in the programs is as direct as that of producers. It is in furtherance of their interest that handlers are expected to present at the hearing as complete evidence as possible, either supporting or opposing the various provisions which have been proposed. Where certain provisions appear to be incompatible with the legitimate interest of handlers, counter proposals should be made and supported by evidence which, in the handlers' opinion, would best serve their interests and still carry out the purposes of the act. This participation by handlers is of particular importance because they are usually in a position to present important data, going back many years, which might not otherwise be available.

THE INTEREST OF CONSUMERS

The role of consumers in the formulation of a sound regulatory program is somewhat different from that of either the producers or handlers, but it is none the less very important. The consumer interest is identified with the broad public interest in an uninterrupted supply of high-quality milk at prices which permit a high

level of consumption. The act pays special attention to this interest in declaring the policy "to protect the interest of the consumer * * *" by raising the level of prices to producers "by gradual correction of the current level at as rapid a rate as the Secretary of Agriculture deems to be in the public interest and feasible in view of the current consumptive demand in domestic and foreign markets. * * *" An intelligent expression of consumers' views is considered important to the development of a sound program.

GOVERNMENT'S PART

The role of the Government in the development of a program is to carry out the purposes of the act by guiding this development from the very beginning. Field representatives of the Department are available for consultation with responsible producer, handler, and consumer groups in the various markets who may be interested in the marketing-agreement program.

Once a hearing is called, on a proposal from groups in a market, the Government's interest is to obtain the facts necessary as a basis for a sound program. Full opportunity is afforded by the officer in charge of the hearing for all persons to present relevant testimony. While a certain degree of formality is, of course, necessary to the conduct of such a hearing in a businesslike manner, this formality is not such as would prevent even the inexperienced witness from having his say. It is the Department's practice to gather together in the form of a mimeographed statement a compilation of factual material in its possession regarding the market, together with an explanation of the more important provisions of the proposal which is to be considered. This material is made available at the hearing for the use of all interested parties.

COOPERATION NECESSARY

When all interested groups cooperate fully and intelligently in the development of a regulatory program, such a program can be formulated with a complete understanding of the conditions in the market, and it is most likely to be developed in the best interests of each group. Without such full and intelligent participation on the part of producers, handlers, and consumers, the program which is developed may fall short of meeting the market's problem, or may, in certain respects, fail to promote the best interests of the market.

FEDERAL-STATE PROGRAMS

In some fluid-milk markets the character of commerce is such as to make desirable joint Federal and State action in providing a regulatory program. The issuance of orders complementary to, or concurrent with, the orders of State authorities is authorized by the Marketing Agreement Act. Such joint orders for particular markets have been discussed with 11 States: Alabama, California, Connecticut, Indiana, Kentucky, Louisiana, Massachusetts, Michigan, New York, Oregon, and Pennsylvania. Memoranda of cooperation have been signed by the Secretary and the authorities of 4 of these States—Indiana, Massachusetts, New York, and Pennsylvania.

By the end of the fiscal year there were in force joint or complementary orders in four markets: Fort Wayne and La Porte, Ind.; Lowell-Lawrence, Mass.; and New York, N. Y. A marketing agreement and order for the New Orleans, La., marketing area was in process of development to complement similar regulation issued by the Louisiana State authorities.

MILK PRICE FIXING

The need for Government regulation of milk prices arises out of the nature of the product and the intricacies of marketing it in fluid form. The production and marketing of milk are characterized by peculiarities and difficulties which frequently result in serious disruption of the marketing processes and decline in the level of prices for the product. These difficulties inhere in both the physical character of the product itself, and in the peculiar economic conditions under which it is necessarily marketed. It is well understood that milk in its fluid state is both highly perishable and very bulky. It is an excellent medium for the growth of harmful bacteria and, hence, although it unquestionably has a high nutritional value, if proper safeguards are not erected around its production and sale, a serious menace to public health may result.

MARKET INTRICACIES CONSIDERED

In order to provide consumers with such a highly perishable product, which at the same time in relation to its raw product value is also very bulky, and which is produced as far as 300 to 400 miles away from the point of consumption, it is necessary to set up an expensive and delicate marketing mechanism. In the smaller markets, milk is delivered directly from the farms to the city pasteurizing and distributing plants. In order to accomplish this delivery on a regular schedule, consistent with the speed and efficiency necessary to preserve the quality and wholesomeness of a perishable product, the application of extensive resources, both physical and human, is required. In larger markets, the collection function is even more intricate, and involves the use of collection points—the so-called country stations—distributed strategically throughout the milk supply area. Here milk is delivered from farms, weighed, tested, and cooled, and thence delivered in large quantities, frequently in tank cars or tank trucks, to city pasteurizing plants. After the milk is delivered in the market, it must be pasteurized, bottled, and delivered to homes or stores, all on a very rigorous time schedule.

POSITION OF PRODUCERS

Because of the intricacies of the milk marketing process, milk producers can have only little direct contact with their market. Producers are located at some distance from the market to which their milk is delivered, and at best can have only limited personal contact with the persons to whom they sell their milk. Moreover, because of the collection systems, the number of outlets available to farmers in any locality are often extremely limited. Frequently dairy farmers have only one dealer to whom it is practicable to sell milk. For this reason, milk producers do not have the choice of selling their product

to the highest bidder, as is commonly supposed to be the case in the marketing of other products.

The dependence on a single buyer for a market becomes even more significant when the inherent peculiarities of milk production are considered. As has already been pointed out, milk is highly perishable and easily contaminated. Many safeguards have been erected in the marketing processes to protect its purity. But no amount of safeguarding in marketing can effectively counteract carelessness in production. For that reason, it is a common practice for public health officials to require that certain standards of sanitation be maintained in the production of milk. These standards usually are much more rigorous with respect to milk which is produced for sale in fluid form, than for milk produced for manufactured products such as butter, cheese, and evaporated milk. Such physical equipment as cooling devices, milk houses, and screening are usually required, all of which add to the cost of producing milk of a quality suitable for sale as fluid milk.

In addition to the requirements for physical equipment, it is also necessary to follow many time-consuming practices such as frequent cleaning of barns and stables, washing cows, and sterilizing equipment. These practices, by requiring the expenditure of additional time which could be spent either in handling more cows, or in developing other farm enterprises, also increase the cost of producing milk for fluid use.

SUPPLY AND DEMAND FORCES

Another characteristic of milk, which further complicates its marketing and pricing, is the seasonal nature of the supply of, and the demand for, fluid milk. The production of milk varies widely from season to season as a result of the seasonal variation in the availability of succulent foodstuffs and the biological cycle of cows.

Ordinarily, the volume of milk production is greatest during the months of May and June, when cows are put out on fresh pastures. In addition, many farmers arrange for cows to freshen during or just prior to the pasture season, and it is in the period immediately following freshening that a cow produces the most milk. The combination of spring freshening, and the availability of succulent feed, results in the production of much more milk in the months of May and June than at any other time of the year. It is not uncommon in some areas, for milk production to be 100 percent greater in May and June than in November, the month when milk production is usually lowest.

The demand for fluid milk, on the other hand, does not ordinarily vary from season to season relatively as widely as production. However, demand frequently varies much more than supply from day to day. Changes in the weather, changes in population, and relative degrees of prosperity among consumers are among the unpredictable factors responsible for changes in the demand for milk.

SEASONAL SURPLUS

Because of the lack of relationship between the supply of milk and the demand for milk seasonally, it is important that the supply of milk produced during the period when production is lowest be

adequate for the market's needs at that time. Consequently, the greater production of milk in the other months of the year supplies the market with more milk than can be sold in fluid form at the prices paid for fluid milk during the period of short production. As a result, a seasonal surplus of milk arises, which acts to depress prices to the very low levels paid for milk used for manufacturing purposes.

The very precipitous reduction in prices which occurs with the advent of surplus milk is caused by the fact that when prices are reduced consumers do not buy large additional quantities of milk and thereby consume the surplus. Even when prices for high quality milk fall to the level of prices paid for milk of the much lower quality used for manufacturing purposes, consumers still do not use all of the milk produced, and considerable quantities of it must be used in the production of manufactured milk products. Thus, while the farmer's cost of producing milk for fluid consumption is higher than it would be if he were producing only milk for manufacturing purposes, it has always been difficult for him to receive remuneration for the added expense involved in the production of fluid milk.

PRODUCERS SEEK MARKET STABILITY

Efforts of fluid-milk producers to improve their lot, and to protect themselves against the precipitous price declines which have characterized their industry, have taken many forms. Among the most familiar efforts to gain a degree of control over the price of their product have been the formation of the several types of cooperative marketing associations, the organization of milk strikes, and the fostering of legal machinery whereby their rights would be more fully protected. The most important aspect of these efforts has been the formation of the cooperative marketing associations. These associations have usually taken one of three forms: The bargaining association, which is the most numerous type; the operating cooperative, which owns or operates some facilities, usually country stations and manufacturing plants; and the retail distributing associations. These categories are not precise, but rather indicate merely the general types. Some associations would fall into two or all three of these categories with respect to the several functions that they perform.

DEVELOPMENT OF COOPERATIVES

Cooperative milk marketing associations probably owe their origin to the peculiar circumstances of milk producers as the sellers of a product. As was indicated earlier, milk producers characteristically live at some distance from their market; they frequently have only one buyer available to them; their product is perishable; the supply of it cannot be effectively controlled within short periods; the demand for it in fluid form is apparently inelastic, except as buying power rises among low-income groups, and, as a partial result of the last three factors, the price is subject to rapid and wide fluctuations. All of these circumstances probably combined to indicate to milk producers the need for an agency which would act as a salesman for their product, their representative in the market in matters of price determination, and as an agency through which producers could

obtain a better control of the supply of their product and thereby of its price.

While cooperative milk-marketing associations had had some degree of success as salesmen for their members' milk, and as representatives in matters of price determination, they have been unable to exercise control over prices which would be effective for any considerable period of time. In their early attempts at price control, cooperatives generally bargained for flat prices. However, the repeated argument that surpluses prevented price increases led the cooperatives to bargain for separate prices for milk used for sale in fluid form, and for milk used for manufactured products—the so-called surplus. Bargaining for separate prices for milk according to use gave rise to the present classified-use plan of selling milk. This plan is widely employed by cooperatives throughout the country, and is incorporated in all Federal regulatory programs for milk.

DEALING WITH MILK BUYERS

Cooperatives had hardly developed the classified-use plan as a method of pricing milk in such a manner as not to allow the surplus to depress the price for all milk when they were faced with the problem of the flat-price buyers. Under the classified-use plan, milk is sold to handlers at separate prices based on its value in the different uses. Milk for fluid use usually is sold at the highest price, milk for cream at a somewhat lower price, and milk for manufacture into products such as butter and cheese at the lowest prices. When producers are paid, they receive an average, or blend, of all of the prices weighted by the amount of milk sold in each class. Since there is almost always some milk sold in the lower-priced classes, the price which farmers receive for all their milk is lower than the price handlers paid for the milk used for fluid distribution.

On the other hand, in any market of considerable size, there are always a few handlers who engage only in the distribution of fluid milk. Such handlers have found that it is possible to buy milk from producers at a flat price equal to, or slightly higher than, that being paid by the cooperative for all milk, but which is substantially less than the price charged for milk for fluid distribution. With milk for fluid distribution bought cheaper than that of his competitors, the flat-price buyer is able to increase his business by cutting resale prices. The cooperative, in turn, in order to allow its buyers to compete effectively with the cut-price milk, also is forced to reduce its class 1, or fluid milk, price. But this reduction in class 1 price also reduces the blend price it can pay its producers, and allows the flat-price buyer in turn to reduce further his price to producers. Once the succession of price cutting starts, the price to producers usually declines to about the level of prices for manufacturing milk, and the premium which producers should receive for extra-quality milk is eliminated.

GOVERNMENT AID SOUGHT

Although the problem of recurrent price collapses and disorganized marketing processes was serious enough before 1930, when population centers were increasing and the consumption and prices for milk were rising, after 1930 the price of milk was continually being

depressed by the reduction in consumption of milk and other dairy products, and by the unprecedented competition among the various groups to retain or expand markets in the face of declining incomes. It was under these circumstances that cooperatives called upon Government for aid. Primarily, Government aid in fluid markets has taken the form of instituting universal application of the classified-price plan, and thereby eliminating the problems brought about by the presence of flat-price buying, the absence of any degree of price control by producers, and other circumstances which have characteristically resulted in disastrous price declines to milk producers.

ELEMENTS IN PRICE MAKING

Numerous elements must be considered in determining prices for milk in regulated markets. The propriety, or reasonableness, of a price for milk in a given milk market can be determined in a measure through the application of either or both of two approaches. The first involves the use of prices for dairy products which are determined by wider competitive forces than those in a particular local fluid milk market. The second approach involves the use of historical data on prices in relation to receipts and sales in the market.

ONE METHOD

In using the first approach for determining whether prices in a local market are reasonable, prices for milk used to make a basic dairy commodity such as butter or evaporated milk, or open market prices for cream, would be ascertained approximately at the extremity of the milkshed. The prices for milk used in these manufactured products are ordinarily thought of as being largely affected by Nation-wide conditions of supply and demand for dairy products, and as being affected only to a minor degree by local conditions. Hence, such prices represent the basic competitive price for milk of manufacturing quality at the outer edge of the milkshed. To this, price increments must be added for transportation costs and for the added costs of producing milk in compliance with the more stringent sanitary requirements of fluid markets. If the price of fluid milk is to be determined, a transportation allowance equal to the cost of transporting milk in fluid form from the edge of the milkshed should be added to the basic manufacturing price. If the price of milk for use as cream is to be determined, then the transportation premium would be equal to the cost of transporting the milk equivalent of the cream in the form of cream.

When a price for fluid milk has been determined in this way, it may be compared with the prices actually paid in the market. In making this comparison, certain additional and intangible elements must be taken into account, such as the particular value to certain handlers of relatively nearby supplies, adjustments in production made by producers to service more adequately their particular outlets, losses that may be entailed in handling reserve supplies commonly termed the "surplus," and convenience to inspection authorities in the maintenance of proper sanitary standards. It should also be noted that the use of this approach is limited by the difficulty of making adequate determinations as to the cost of meeting sanitary regulations on farms, and proper allowances for the various intangibles.

THE SECOND APPROACH

The second approach is probably easier to apply in practice than is the first. This approach is concerned with a study of the past relationships between prices on the one hand, and sales and deliveries of milk on the other. It also has limitations which arise from the fact that price alone, especially over short periods of time, is not the only factor exerting an influence on supply and sales of milk. After considerable periods of time, other things being the same, it is usually true that relatively high prices call forth increased supplies of milk. Thus, if prices to producers in a market are too high, increased supplies of milk become available which are not used in fluid form, but are made into the manufactured products. A good practical test, therefore, of whether prices to producers are higher than appropriate is the degree to which such prices appear to be calling forth increasing quantities of milk which have no use except for manufacturing purposes.

BOTH HAVE THEIR LIMITATIONS

In summarizing, it needs to be emphasized that both of these methods are subject to important limitations. Neither provides a complete and precise standard, and, wherever data are available, both approaches should be used. However, recognizing the limitations of the two approaches, and using the results mostly in the nature of guides, it is possible to form reasonable judgment respecting prices in a particular market.

GROUP INTERESTS IN MILK-MARKET PROGRAMS

The groups most interested in regulatory programs are the producers, the handlers, and the consumers. Although each has an interest, its focal point is different, and it may be said that some of the interests in the market are diametrically opposed to each other.

PRODUCERS AND PRICES

The milk producer is interested in the regulatory program as a device for increasing his net income. Whether all milk producers realize it or not, there is a definite limit to increases in income which can be obtained through the use of regulatory measures. Theoretically, on the short-time basis, producers' incomes cannot be increased beyond the point where, through the use of efficient devices for stratifying the demands in the several uses of milk, the total income from the sale of milk is maximized. But such an objective, if achieved, would necessarily be short-lived. The prices paid producers would be relatively high. Because the act specifically forbids any type of production control and permits no prohibition against milk produced anywhere in the United States, the market where such a price structure was maintained would soon be receiving large quantities of milk in excess of its requirements. If the class prices were maintained long enough (and this would probably be impossible), prices to producers would be reduced through the influx of additional supplies, until a new equilibrium was obtained.

Producers' prices might be higher under the new equilibrium than previously, but costs would also be higher, and producers would have

availed themselves nothing by maintaining prices at unreasonable levels. But during this process of readjustment, first to higher price levels and then to lower ones resulting from increased supplies, a great strain would be placed on the regulatory program which might result in its complete breakdown and the collapse of the price structure. Producers would then find themselves selling in a market characterized by great excesses of milk supplies, with no stabilization program at a time when one would be most needed. Thus, it appears to producers that their best interest is served by sponsoring movements to increase prices. This is true if such price increases are sound in relation to the economic conditions in the market. However, price increases which are not sound and which result in uneconomically large supplies being available for a market, can only work to the disadvantage both of producers already serving the market, by setting in motion forces which tend to disorganize and disrupt the orderly and efficient marketing processes, and of producers who invest their capital and effort to participate in the market.

HANDLERS AND MARGINS

In their attempt to get the greatest returns from their business, handlers are interested primarily in their margins, or the spread between the price they pay for milk and the price at which it is sold, and the volume of sales. Over longer periods of time, they should be interested in being able to purchase milk from producers at the lowest prices which will continue to bring forth an adequate supply of milk. During shorter periods, however, handlers frequently act in a manner which suggests that they desire to purchase milk at the lowest possible price, irrespective of whether such a price is likely to enable producers to continue to supply milk, once their inventory of farm resources has been drastically reduced. But for the most part, having assured themselves of adequate supplies, handlers are interested in maintaining margins at a point so that the difference between their total income and their total cost is as great as possible. Whether this margin is relatively large or small depends on many factors, including the relationship of variable to fixed costs, and the degree to which consumer preference for the individual handler's product can be maintained.

Most handlers are also interested in the enforcement of the regulatory program. They believe that if all handlers are required to pay the same price for milk sold as fluid milk, unfair competition resulting from the buying of milk at lower prices by some handlers will be eliminated. Where such competition is eliminated, destructive price cutting to consumers may be prevented, and the price wars, detrimental to both producers and handlers, may be brought to an end.

CONSUMERS AND THE COST OF MILK

In general, the interest of the consumers is to purchase milk at a price low enough so that they can obtain economically a quantity adequate for their needs. However, consumers do not wish the lowest price possible, for they are concerned that the producers receive prices such that an adequate supply of milk of high quality is at all times

guaranteed to them. Nor do consumers wish to see prices such that distributors' margins are decreased to the extent that they are forced out of business. They wish to have milk prices as low as possible, and yet maintain their supply of milk, together with adequate processing and distributing services. For this reason, they are interested in having prices to producers at levels which will assure an adequate supply of milk over a long period of time. With respect to handlers, consumers believe that spreads should be sufficient only to maintain the capital and labor necessary efficiently to provide them with the distributing services.

OBJECTIVES OF MILK-MARKET REGULATION

The objectives of a regulatory program are to bring about a reasonable and just balance between the various interests in the milk market. In the short run, they are primarily to insure the producer an adequate return for his product. In the long run, they are primarily to insure the market of an adequate supply of milk and to aid farmers in securing enough compensation for the continued production of an adequate supply.

The short-run objective is of importance as an emergency measure. The program is usually designed to bring about an immediate increase in price to the producers. A price increase is usually in order, because, generally speaking, the request for a regulatory program usually comes after other means of controlling the market have failed. Producers are particularly vulnerable in their position relative to consumers and handlers in the market, because of the nature of the dairy-farming business, and because of the nature of the competition among farmers for markets for their milk. Producers of milk have relatively heavy investments in land, buildings, and machinery, and, at the same time, have very little bargaining power with handlers. Because of their specialized investment, the alternative farm enterprises for dairy farmers are usually quite limited. Frequently they are practically forced to accept whatever prices handlers wish to pay them for milk, because they cannot readily convert their investment into cash to start the production of some other crop. Therefore, dairy farmers continue to produce milk even after they no longer receive a price for it greater than the marginal cost of production.

Over a longer period of time, because of freedom in most markets of entry into the milk-producing business, and because of the lack of differentiation of the product of individual producers, probably no income advantage can be secured to milk producers other than that attributable to the development of stabilized conditions in the market, to decreases in the risks involved in milk production, or to other similar factors.

THE ULTIMATE GOAL

Stability in the industry marked by reasonable prices is the ultimate goal of regulation. The establishment of prices to producers at a reasonable level will enable them, over a long period of time, to continue to produce an adequate volume of milk of required high quality. Such a price should return producers an adequate standard of living, but should not induce more producers into the field of milk production

from other farm enterprises than are necessary to provide an adequate supply of milk.

It is desirable to have the class 1 price, or the price of fluid milk, as low as possible, and at the same time have the blend price, or the price paid to producers, as high as is consistent with securing only an adequate supply of milk. This price objective may be best accomplished in part by assisting producers to get the greatest returns from surplus milk, or that milk used for purposes other than fluid milk, and in part by the maintenance of class 1 prices at a level consistent with heavy consumption of fluid milk.

The amount of surplus milk supplied the market should be kept at a minimum over a period of years. It is economically wasteful to encourage the production of milk that meets stringent sanitation regulations, and use it for manufactured milk products where the milk so used need not meet expensive sanitation regulations. However, a certain amount of surplus must be available, even during the season of short supplies, in order to allow for changes in either the demand or the supply. A long-time program, which accomplishes these objectives, is in the public interest.

COOPERATIVES AND MILK-MARKET REGULATION

From the earliest beginning of milk-market regulation, the part played by cooperative organizations of milk producers has been of major significance. This was true not only in the sense that these organizations were among the active sponsors of the legislation which incorporated provisions for milk regulatory programs, but also because their own marketing programs largely provided the basis for regulation by governmental agencies.

Governmental programs for the regulation of milk marketing may be considered as largely an extension and continuation of the work of cooperative marketing associations. The objectives of the governmental programs bear a striking similarity to the objectives of the cooperative programs, and it was these programs which provided the pattern or framework for the governmental programs. One of the major objectives of milk cooperatives is to increase returns to producers through improving their bargaining position and to establish orderly marketing conditions for the product of their producer-members. As compared to this, the policy of Congress as stated in the Marketing Agreement Act is to encourage such orderly marketing conditions for milk as will establish prices at the so-called parity level. If the parity price is found to be unreasonable in view of local supply and demand conditions in the marketing area under consideration, such prices may be fixed as will reflect those conditions, insure a sufficient supply of pure and wholesome milk, and be in the public interest.

The marketing methods authorized by the act also are similar to those first developed by cooperatives. For example, the classified price plan of selling milk to producers, included as one of the terms of the orders issued under the Marketing Agreement Act, was originally developed and used by cooperatives. Cooperatives also developed the individual-handler pool and market-wide pool as methods of prorating to producers the proceeds of sales to handlers. Orders issued under the act provide for one of these types of pools.

COOPERATIVE FUNCTIONS NOT DISPLACED

Through the milk market regulatory programs, the Federal Government does not undertake to perform the functions of cooperatives but rather to supplement their activities. Some functions of the cooperative remain entirely unaffected by Federal regulation. The services rendered producer-members by the cooperative, other than the negotiating of prices with distributors, are not attempted by the Government. The cooperative still has the problem of selling the milk of its members under the fixed prices. It also has the problems of checking the weights and tests of members' milk and of guaranteeing members a market outlet. While it may be true that the price-making functions of cooperatives are modified to some extent, the modification probably is more apparent than real, particularly in light of the limitations imposed by the act and the methods authorized for the promulgation of orders. Not only was the act drafted in such fashion that cooperatives are to be definitely encouraged under it, but regulatory experience indicates that, unless there is a strongly functioning cooperative in the market, the cornerstone for a successful program is lacking.

RECOGNITION ACCORDED COOPERATIVES

The place of cooperatives in a regulatory program is definitely recognized in a number of ways by milk control legislation passed by both State and Federal Governments. The Marketing Agreement Act confers several prerogatives upon cooperative associations which entail corresponding responsibilities.

VOTE FOR MEMBERS

Section 12 of the act provides for cooperative association representation in the determination of producer approval of a proposed order. Under this provision, the Secretary of Agriculture shall—

> * * * consider the approval or disapproval by any cooperative association of producers, bona fide engaged in marketing the commodity or product thereof covered by such order, or in rendering services for or advancing the interests of the producers of such commodity, as the approval or disapproval of the producers who are members of, stockholders in, or under contract with such cooperative association of producers.

By this provision, a cooperative, if it so chooses, is permitted to voice a unified opinion on the question of adopting or rejecting a regulatory order.

CONTINUE SERVICES

Section (5) (E) provides for the furnishing of certain marketing services to producers in a market under regulation, except to those producers being furnished such services by a qualified cooperative. This provision of the act recognized the function of cooperatives in performing certain services for its members, such as the checking of weights and tests of members' milk. While Congress recognized the value of these services in contributing toward stability in milk marketing, and wanted to insure their extension to the entire market brought under regulation, it apparently did not want cooperatives already furnishing these services to be supplanted in their function by the agency administering the Federal agreement and order.

MAY BLEND PAYMENTS

Section (5) (F) provides that cooperatives qualified under the Capper-Volstead Act shall not be prevented from blending the proceeds of sales in all markets and distributing them to producer-members according to their contracts with members. This part of the act protects the right of producers organized in a cooperative association to determine their own method of distributing the proceeds of milk sales among themselves. While the Federal orders in milk markets provide a definite method of disturbing the proceeds of sales among all producers in these markets, and so maintain equitable relationships among independent producers and cooperative producers as groups, they nevertheless permit association producers to redistribute these proceeds in accordance with any plan to which they agree. The provision is of particular importance in protecting the integrity of an association marketing the milk of its members in several different markets.

MEDIATION AND ARBITRATION

The act further provides for mediation or arbitration of disputes between dealers and producers by the Secretary of Agriculture or such employee of the Department of Agriculture as may be designated by him when requested to do so by any cooperative association, owned or controlled by producers or organizations thereof, and which is bona fide engaged in collective processing, or preparing for market or handling or marketing of milk or its products. This provision offers a definite service to producers acting through a bona fide cooperative association, which is not available to other producers.

QUALIFICATIONS FOR A COOPERATIVE

As far as its structural form is concerned, an organization, in order to qualify as a cooperative, should meet at least the following requirements:

1. It should have authority to market the products of its members.
2. In case of a stock corporation, dividends should be limited to 8 percent, as required by the Capper-Volstead Act, or that part of the business of the company, where the wishes of the membership are necessary to its conduct, should permit the membership to vote, using the principle of "one man—one vote."
3. It should have as voting members only producers, and preferably those who are producing the commodity being marketed by the association. In the case of a nonstock cooperative, only active producers should be members and have voting privileges, and in stock cooperatives, the voting stock should be limited to actual producers.
4. The rules for the election of officers of the organization should be such that control by a small minority would be practically impossible.
5. The means by which producers can become members should be open, and should provide for the assumption of definite obligations by both the producer and cooperative.
6. Its nonmember business should not exceed member business in terms of value or quantity.

Presumably, it is possible to determine whether an organization meets these listed requirements rather quickly by reference to its

articles of incorporation, bylaws, membership contract, and records showing the volume handled for members as compared to that handled for nonmembers. However, the problem of determining whether the organization actually is producer controlled may be quite difficult, since, although all requirements may be met on paper, investigation of the manner in which the cooperative operates may show that the requirements are not met in actual operations.

RESPONSIBILITIES OF COOPERATIVES

Because the Federal regulatory programs are an outgrowth of the work of the cooperative associations in improving the position of the producer in marketing his product, and because these associations have been granted important prerogatives by Congress in connection with the carrying out of these programs, the cooperative associations have had to bear important responsibilities in connection with these measures. The responsibility of the cooperatives is a continuing one. It starts with the petitioning of the Secretary for a public hearing on a proposed agreement and order and continues at each step of the way thereafter. The cooperative is largely responsible for presentation of evidence at the hearing; it bears a key responsibility when the instrument is presented to producers for their approval; and, when regulation is made effective, its success and continuation depend largely upon the intelligent and active support of the cooperative.

Once a regulatory program is adopted in a market, the cooperative association must be alert to changing circumstances in the market which may make changes in the program necessary, and it must be ready to propose and support such changes. At the same time the association must carry out its own functions as a cooperative. A sound, growing cooperative is essential to a sound marketing program. It must continue performing its services for its members and must maintain control over the allocation of sales to handlers in a manner contributing to the stability of the market. The organization must be ready to carry out its functions as a bargaining agency to obtain prices for its members above the minimum prices established by the program, whenever conditions arise which make such higher prices desirable.

RIGHTS OF PRODUCER GROUPS ESTABLISHED

The prerogatives extended by the act to cooperative associations have been challenged at various times. The recent decisions of the Supreme Court in the New York and Boston milk cases have served to clear up several questions in regard to these prerogatives. These questions involved the constitutionality of the provisions of the act relating to (1) producers' approval of orders, (2) the right of cooperative associations to cast the votes of their members, and (3) exemption of cooperatives from uniform pricing provisions of orders. In addition to these constitutional questions, further questions were answered by these decisions relating to (1) the rights of a cooperative to campaign during a producer referendum, (2) the right of a cooperative to vote in a producer referendum without polling its membership, and (3) the status of an agent type of cooperative as distinct from the sale type of cooperative.

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PRODUCER VOTING

In the New York case, objection was made to the provision of the act with respect to producer approval of the issuance of an order. This was alleged to constitute an unlawful delegation to producers of the legislative power to put an order into effect in a market. The Court in its opinion stated:

In considering this question, we must assume that the Congress had the power to put this order into effect without the approval of anyone. Whether producer approval by election is necessary or not, a question we reserve, a requirement of such approval would not be an invalid delegation.

Upon the question raised with respect to the authorization of cooperatives to cast the votes of producer patrons, the Court stated:

This objection, too, falls before the answering argument that inasmuch as Congress could place the order in effect without any vote, it is permissible for it to provide for approval or disapproval in such way or manner as it may choose.

On the question of whether a cooperative association must conduct a formal poll among its members prior to voting in the producer referendum, the Court said in the Boston case:

Section 8c (12) directs the Secretary to consider the approval or disapproval of cooperatives as the approval or disapproval of members. This is complete authority for the action of the Secretary. He need not require further referendums by cooperatives themselves. Presumably they will vote with an eye to the best interest of their members.

Another matter relating to cooperatives, which was reviewed in the New York case, was connected with the campaign conducted by an association for the adoption of the order. It was alleged that activities of the association prior to the producer referendum were marked by fraud, misrepresentation, and coercion. The specific allegations of fraud and misrepresentation were examined by the Court and found to be insufficiently substantiated in this case. With respect to the allegation of coercion, the Court stated:

The coercion * * * exercised upon the handlers after the adoption of the order to force or induce them to acquiesce in its operation, is of the same indirect character as the alleged misrepresentation. It is the partisan coercion of the producer seeking to compel dealer support of the plan by the threat of the use of his economic power over his own milk. * * * These associations of producers of milk have a vital interest in the establishment of an efficient marketing system. This adequately explains their interest in securing the adoption of an order believed by them to be favorable for this purpose.

DISTINCTIONS DRAWN

The objection to the provision of the act and the New York order which excepted producers' cooperatives from the requirement to pay the uniform price for milk is dealt with in the following manner by the Court:

These agricultural cooperatives are the means by which farmers and stockmen enter into the processing and distribution of their crops and livestock. The distinctions between such cooperatives and business organizations have repeatedly been held to justify different treatment.

A further question with respect to cooperatives in the New York case was whether a cooperative which acts as the agent for its members was to be treated in the same manner as the "sale" type of cooperative which purchases the milk of its members and markets such milk

on its own account. The Court ruled that no distinction was intended either in the act or in the New York order between these two types of cooperative associations.

LOOKING AHEAD

In all probability the future of the cooperative movement in the dairy industry is very closely tied up with the future of regulatory programs. This appears to be true because the existence of the regulatory programs was largely the result of the efforts of the cooperatives. The regulatory programs represent an extension of cooperative principles to stabilize milk marketing and to improve the well-being of dairy farmers. The existence of the regulatory programs does not mean that there is a lessening in the importance or responsibility of cooperatives. It merely creates a new channel into which cooperative effort may be directed. It would be impossible to have the type of regulatory program which exists today without strong cooperative organizations. By the same token it is becoming increasingly apparent that successful regulatory programs are necessary if cooperatives are to succeed in fulfilling the functions for which they were organized.

If the success of regulatory programs is important to the successful continuation and expansion of the cooperatives, it is essential that they work intelligently to promote sound regulatory policies. Such policies can be promoted only by cooperatives which understand the limitations as well as the potentialities of regulation.

A COURSE TO FOLLOW

In their support of a regulatory program, cooperatives must sooner or later discover that such a program must take into consideration the interests of all groups, including consumers, handlers, and producers who are not members of a cooperative. They must give consideration to consumers who are interested in an uninterrupted supply of milk of high quality at a fair price. The cooperatives must also avoid proposing measures which do not take full cognizance of the welfare of nonmember producers, for their support is also necessary for a successful regulatory program. Lastly, the cooperatives wishing to promote a successful regulatory program must give some consideration to the effect of the program upon the handlers to whom they must sell their milk. A sound regulatory program should promote the legitimate business interests of the handler who wishes to operate at a reasonable margin of profit while paying a fair market price to producers for his supplies of milk.

PUBLIC OPINION

As the regulatory programs are developed and experience is gained by the cooperative leaders and governmental officials in carrying them out, these factors are being given greater recognition and the basis is being laid for a sound relationship between the cooperatives and the programs. In the long run, however, public opinion will determine the continuance of the regulatory programs for milk. This opinion will be formed largely upon the results of the programs as they affect the well-being of all groups—consumers, handlers, and producers.

MARKETING AGREEMENT PROGRAMS FOR CROPS

Marketing-agreement programs in effect during the fiscal year for commodities in the fresh-fruit and vegetable field, and for nuts, hops, and tobacco totaled 20, of which 13 were in actual operation. All of the programs were in effect through marketing agreements and orders, except one program for Connecticut Valley shade-grown tobacco which continued through a marketing agreement and license. Commodities under these programs had an annual farm value of over $130,000,000 and were produced by more than 90,000 growers.

SCOPE OF OPERATIONS

Activities in connection with marketing-agreement programs in this field included the supervision of existing programs, the analysis of supply and demand conditions affecting the marketing of the various crops, analysis of problems arising out of the operation of the different programs, cooperation with State agencies in the development and operation of authorized programs to improve selling conditions for producers, and cooperation with producer and handler groups in activities designed to encourage better understanding and more effective action among the various groups in dealing with marketing problems and crop surpluses.

During the year a number of requests were received from producer and handler groups interested in the development of new marketing-agreement programs or in revising programs already in effect. By the end of the fiscal year several public hearings had been held or were contemplated as a result of these requests. Four of the marketing-agreement programs in effect were terminated during the year because they had either become inoperative or were to be replaced later by new programs.

TABLE 2.—*Estimated number of growers and approximate annual farm value of crops for which marketing agreement programs were in effect during the fiscal year 1939*

Marketing agreement program	Number of growers	Farm value (1,000 dollars)	Marketing agreement program	Number of growers	Farm value (1,000 dollars)
Walnuts—California, Oregon, and Washington [1]	14,000	11,237	Hops—California, Oregon, and Washington [1]	1,274	5,546
California-Arizona citrus [1]	20,000	43,412	Package bees and queen bees [1]	250	450
Western Washington vegetables	1,300	1,146	California, Oregon, and Washington fall and winter pears [1]	3,000	1,600
Watermelons—Florida, Georgia, North Carolina, and South Carolina [1]	10,000	2,518	Florida citrus [1]	20,000	35,155
Colorado vegetables [1]	250	946	California Elberta peaches, Bartlett pears, plums, apricots, and cherries	7,000	6,784
Utah onions	180	220	Mississippi tomatoes	2,750	540
Texas citrus [1]	7,500	6,190	California Hardy pears [1]	500	270
Oregon cauliflower	300	88	Connecticut Valley shade tobacco [1]	54	3,636
Florida celery	385	3,289	Total programs in effect	90,422	133,009
Cantaloups—Imperial County, Calif., and Yuma County, Ariz.	79	9,413	Total programs in operation	78,007	120,672
Arkansas grapes [1]	1,000	192			
Fresh prunes—Eastern Oregon and eastern Washington [1]	600	377			

[1] Operative during the fiscal year 1939.

WIDE RANGE OF PRODUCTS

The programs for the various crops cover a wide range of commodities produced in widely scattered sections of the country. For example, during the last year marketing agreement programs were in effect for Pacific coast walnuts and hops, for package bees and queens produced in the Southern and Western States, and for shade tobacco grown in the Connecticut Valley. These may roughly be classified as nonperishable commodities. Citrus fruits grown in the principal producing areas of California-Arizona, Florida, and Texas may be classified as semiperishable commodities for which programs were in effect. Other marketing agreement programs included the following perishable commodities: Watermelons grown in the Southeastern States; Colorado peas and cauliflower; cantaloups, Honey Ball, and Honey Dew melons grown in the Imperial Valley of California and Yuma County, Ariz.; Arkansas grapes; fresh prunes grown in Oregon and Washington; and fall and winter pears grown in the Pacific Coast States.

The size of the various agricultural industries affected by marketing agreement programs varied greatly. In the package bee and queen industry, for example, there were roughly 250 producers, each of whom was a handler. In California-Arizona citrus, on the other hand, there were approximately 20,000 producers and 150 handlers, or shippers. It is estimated that there were approximately 15 shippers of fresh Italian prunes grown in Oregon and Washington, while there were nearly 600 shippers of oranges and grapefruit grown in Texas during the 1938–39 season.

MAIN PROVISIONS OF PROGRAMS

The marketing agreements and orders in general provide for an administrative agency, and for the issuance of regulations to govern the handling of the commodity, or shipments out of the defined producing area. The administrative agency is dominated by the membership of growers, and it usually consists of one committee named from among nominees elected by growers and handlers to represent the respective group interests. In some instances, there are two committees, one of growers responsible for administrative action, and the other of handlers who act in an advisory capacity.

Recommendations for regulations which are to govern shipments are made by the administrative agency to the Secretary of Agriculture, who is responsible for putting any regulation under a marketing agreement program into effect. The nature of the regulation varies with conditions both in the producing area and in the markets, and is governed by the limitations prescribed in the marketing agreement and order and by the Marketing Agreement Act.

OPERATING PROBLEMS VARY

The problem of regulating shipments differs with each crop and with each season. One consideration is the length of time during which a commodity may be stored. This, of course, varies with the degree of perishability of the product. The length of the harvesting season likewise affects the nature of the regulation which may be

issued, and there are many commodities which must be harvested as soon as they are mature. Other commodities—certain varieties of citrus fruits, for example—may be held on the tree for a period of several months after maturity has been reached.

Also, the problem of regulating shipments varies with the nature of the marketing institutions in the various industries for which marketing agreement programs are in effect. In the Pacific coast hop industry, the product is processed and made ready for final sale by the growers, while in all other industries for which marketing agreements were operating during the year some form of packaging or processing was completed by handlers. In the Pacific coast walnut and California-Arizona orange industries, more than 85 percent of the total volume of shipments was made through cooperative marketing organizations, while in the California-Arizona cantaloup and Pacific coast hop industries the volume handled by cooperative marketing organizations was relatively small.

ONE COMMON CHARACTERISTIC

There was one characteristic, however, which was common to all the industries in which marketing-agreement programs were in effect during the last year. The distance over which the commodity was shipped to the principal consuming markets in each case was relatively long. It is estimated that the average length of haul to consuming areas was in no case less than 800 miles, and in the case of the Pacific coast industries it averaged over 2,000 miles.

These rough comparisons illustrate the large number of different conditions affecting the various agricultural commodities for which marketing-agreement programs were in effect. Further complications are added by the differences in the markets to which the many commodities are shipped, the variations in the price structure of each and the methods of sale, and by the differences in quality and type of competing products.

FLEXIBLE POLICIES FOLLOWED

A large number of the crops affected by regulations under marketing agreement programs are of a perishable nature, and the time of marketing has a considerable effect upon prices and returns to growers. A difference of a week or two in the period of maturity of Colorado vegetables, for example, may result in a marked difference in the prices and incomes received by growers of these commodities. Furthermore, since there is no carry-over from year to year in the case of most of the perishable commodities, damage to crops from weather conditions may result in extreme variations in marketing conditions. It is impossible to forecast accurately marketing conditions which may prevail from time to time in the case of perishable commodities. Consequently, marketing policies must be flexible enough so that they may be modified readily as conditions during the season change.

PROGRAMS ARE INDUSTRY-WIDE

From a broad standpoint, the marketing programs established under marketing agreements and orders relate to the industry as a whole rather than to a large number of individual producers, as is the

case in a number of the other farm programs. For example, in some programs the individual producer is given an opportunity to determine whether he thinks the advantages accruing from his participation more than offset the disadvantages which may result from his performance under the program. He elects to cooperate under the program regardless of the activities of his neighbor. Furthermore, 100-percent cooperation in the program is not essential for its success. In marketing agreement programs, on the other hand, it is essential that all growers and handlers cooperate. The activities of a very few individuals who do not cooperate may result in the breakdown of the whole program.

In the development of marketing agreement programs, therefore, it is continually borne in mind that these programs are developed for industries as a whole. Careful consideration is given to the development of a program which will treat all growers and handlers equitably and provide standards which will permit adjustments by individuals who might be adversely affected by the operations of the program's provisions.

OBJECTIVES SOUGHT

Marketing agreement programs for farm crops seek to improve and maintain the income and well-being of growers from a long-time point of view. This implies that the nature of regulations and the extent to which they are established for any commodity are judged in the light of longer-time objectives, as well as on the basis of the data relating to the season or portion of the season for which the regulations are established. Whether or not supplies of the given commodity under regulation or of competing commodities indicate increasing or decreasing trends, therefore, may affect decisions relating to the extent of regulation deemed advisable. Similarly, trends in costs, shifts in comparative advantage, and changes in other basic factors may also affect the nature of marketing policies employed in the operation of marketing agreement programs.

TYPES OF REGULATION

Three main types of regulations were used in marketing agreement programs during the last season. Regulations of volumes shipped to principal consuming markets were employed in the case of California-Arizona and Texas citrus fruits, Pacific coast walnuts and hops, and Oregon and Washington fresh prunes. Regulations of grades and sizes shipped to consuming markets were established in the case of Florida and Texas citrus fruits, southeastern watermelons, Colorado vegetables, California-Arizona cantaloups, Arkansas grapes, Oregon and Washington fresh prunes, and Pacific coast fall and winter pears. There were price-posting provisions in effect in the marketing agreement programs relating to Oregon and Washington fresh prunes and to package bees and queens.

ADJUSTING VOLUME OF SHIPMENTS

Volume regulation is designed to control the volume of shipments of a given commodity in specified channels during a given period of time. It is a type of regulation which undertakes to modify available market supplies to what are deemed advisable market supplies with

the view of increasing grower returns. In practice, its application results in surplus pools or restriction of season marketings for nonperishables, and in what is considered orderly flow to market for semiperishable and perishable commodities. It is a difficult type of regulation to administer in that it presupposes thorough knowledge of demand conditions, accurate determination of available supplies, and equitable allotment of the advisable quantity among shippers.

During the year volume regulation resulted in direct elimination of supplies of only one commodity, hops grown on the Pacific coast. In the case of other commodities the principal aim of volume regulation was to market the entire merchantable supply in such a manner as to bring prices and returns to growers above what would have been received in the absence of such regulation. This is one of the main objectives of orderly marketing of supplies.

PROMOTES ORDERLY SHIPPING

The emphasis in volume regulation has been placed on orderly movement of supplies, rather than on curtailment of supplies as was the case in the early years of marketing agreement programs. As condition of demand improved following 1933 and 1934, the levels of demand schedules for growers' products were raised, and grower prices and returns increased above the emergency levels of the depression years. Also, public sentiment, because of rising prices of food staples in 1934, rose against reduction of season supplies of agricultural commodities. The transition from volume restriction to volume regulation reflects a transition from an emergency, or depression, approach to a long-time or normal approach to the problem of improving the welfare of growers in the marketing of their products.

WHEN VOLUME REGULATION IS APPLIED

Volume regulation has been undertaken when conditions of market demand for the commodity in question are such that grower returns would be improved by regulation of the shipments of the commodity. For example, the limiting of the total volume of a given commodity to be marketed during a season may be undertaken when the relationship between the price to growers and the quantity that can be sold at that price is such that growers would receive a larger total return by marketing the smaller volume during the season than by marketing a larger volume.

Also, volume regulation may be put into effect to make possible the diversion of a portion of the total supply to other than normal outlets for the purpose of improving grower returns from the entire crop. For example, Pacific coast walnut growers are able to improve their returns by diverting a portion of the merchantable supplies from the domestic unshelled market into exports and the shelled market. Conditions of demand for walnuts are such that growers receive increased total returns when quantities are diverted from the domestic unshelled market for use in export and shelled outlets.

The volume regulation in effect for Pacific coast hops during the last year consisted of restriction of the total quantity shipped to commercial markets. The regulation carried on in this commodity was unique in that allotments were issued to growers. This was possible

due to the fact that the product is processed and made ready for final sale by the producers. Growers received their allotments before harvesting operations were completed, and, therefore, made savings on the costs of harvesting and marketing that quantity of the product which they were not permitted to sell in commercial channels. This saving in the case of hops was quite substantial, for it is estimated that roughly two-thirds of the entire cultural and marketing costs for hops are incurred in harvesting, drying, and baling the commodity. The economic basis for restriction of total supplies in this case rested on the fact that the demand schedule at the grower point is extremely inelastic.

GOVERNING RATE OF FLOW

Regulations which involve control over the rate of flow to market were established for California-Arizona oranges, Texas grapefruit, and Oregon and Washington fresh Italian prunes during the year. These regulations were designed to facilitate marketing the entire merchantable supply available during the period of regulation in an orderly fashion, and did not directly result in elimination of supplies from commercial channels. In the case of Oregon and Washington fresh Italian prunes, preliminary analyses indicated that growers tended to receive maximum returns for shipments at a certain rate of flow. Through the regulation of shipments under the marketing-agreement program it was possible more nearly to achieve this rate of flow than would have been the case in the absence of regulation. Stated more simply, the performance under regulation prevented the occurrence of a normally glutted market when shipments reached their peak, and analyses indicate that this tended to improve grower returns from commercial sales of the commodity.

As the level of the demand schedule for a commodity during a given period of time is raised or lowered, the volume of shipments at which optimum grower returns prevail is increased or decreased. Grower returns over the season will tend to be improved if the rate of flow of shipments is increased when the demand schedule rises and decreased when the schedule falls. This, in rather technical terms, provides an economic rationale for the recommendations of grower committees for adjusting the rate of flow of their commodity to changing conditions of demand as indicated to them by current market data.

EFFECT OF CITRUS VOLUME REGULATION

The incomes of growers of Texas grapefruit and California-Arizona navel and miscellaneous oranges were maintained, although probably not appreciably improved, by volume regulations in effect for these commodities during the 1938–39 season. The limiting factor with respect to volume regulation for these commodities was the fact that shipments from these areas did not constitute a major portion of the total shipments of these commodities during the period of time in which the regulations were in effect. Consequently, growers from other areas were in position to benefit from the regulations, and the range within which regulations could be issued was limited.

Volume regulation of California-Arizona Valencia orange shipments, however, is believed to have appreciably improved grower returns, since the industry was able to take advantage of fluctuations in its demand schedule during the season. In the early weeks of the shipping season the demand schedule for that product is relatively low in view of the large volumes of competing oranges shipped from Florida. As the season progresses, however, shipments of Florida oranges decline and demand conditions improve for California-Arizona summer oranges. By holding back shipments during early weeks of the shipping season and increasing the rate of flow during the late summer months, growers of California-Arizona Valencia oranges were able to improve returns for their crop.

GRADE AND SIZE REGULATION

Regulation of grades or sizes of commodities shipped to commercial channels was established in eight of the marketing agreement programs operated during the last year. Grade or size regulations were established for more commodities during the last year than in any other year since marketing agreement programs were established.

Regulation of grades and sizes relates to the designation of grades or sizes of a given commodity which may be shipped during any period of time. Although regulations of this nature were permissible under the authority given to the Secretary in the blanket provisions of the 1933 Agricultural Adjustment Act, they were not employed in marketing agreement programs for semiperishable and perishable commodities until the 1934–35 season. Since that time grade and size regulation has been given increased recognition as a mechanism whereby growers of semiperishable and perishable commodities may increase their returns.

THEIR APPLICATION

Grade and size regulations, to the extent that they increase or decrease the total volume of shipments during a given season, or accelerate or retard the rate of shipment within given periods of a season, tend to influence grower returns. A part of the influence upon grower returns is due to the effect of the regulation upon the volume shipped. Grade and size regulation, however, influences grower returns through affecting the quality as well as the quantity of the commodity permitted to be shipped during the period in which the regulation is in effect. Broadly speaking, grade and size regulations have in practice limited the movement of grades and sizes discounted in the market. The generalization has been made that with less desirable portions of the commodity limited by grade and size regulation, the average quality of the shipments to consuming markets has been increased (increased with reference to consumer preference as indicated by consumer purchases) with a resultant average price higher than would have existed in the absence of regulation, and, consequently, higher returns to growers.

In some instances, grade and size regulation has been put into effect to bring about improvement in maturity of shipments of semiperishable and perishable commodities shipped during the early weeks of a season. Experience has indicated that shippers of these

commodities tend to ship immature fruit or vegetables during early weeks of the season in order to take advantage of high prices existing during these weeks when the volume of shipments is small. Industry members contend that immature shipments at this time tend to affect adversely consumer demand for these commodities for a period of time, with resultant depressing effects upon grower returns. Moreover, price analyses indicate that prices received for commodities during these periods are often less than could be expected for the volume of supplies available for consumption. A size regulation may be employed to achieve these results when commodities are of such a nature that they may increase in size and maturity without becoming overripe for shipment.

SOME EFFECTS

Grade and size regulation may result in volume regulation. Elimination of certain grades and sizes from shipment to market tends to result in a decrease in volume of shipments during the given period, though it may result in a larger volume of shipments in a subsequent period if restricted small sizes grow larger without becoming overripe for shipment. Grade and size regulations which are instituted for the purpose of improving maturity of shipments early in the season do not, as a rule, result in elimination of any of the product.

For most perishable commodities grade and size regulations usually result in elimination of the restricted grades and sizes if the regulations are instituted after the early part of the season when the commodities have not reached maturity acceptable for shipment for consumption. Commodities of this nature, when mature, usually cannot be held in the field for any appreciable time without becoming overripe for shipment.

POLICY FOLLOWED

In administering grade and size regulations for perishable commodities during the shipping season when the intent has not been to improve the average maturity of the commodity, the general policy has been to put them into effect only in cases where it was believed that the prohibited grades or sizes would have returned, if permitted to be shipped, prices to growers which would not cover the direct costs of harvesting and marketing the commodity.

PROVISIONS FOR PRICE POSTING

Price posting relates to the provision which may be incorporated in a marketing-agreement program to the effect that no shipper may quote, offer for sale, or sell the commodity at prices other than the prices contained in his posted schedule. In the event of a price change, shippers may issue new price schedules, but are not permitted to quote, offer for sale, or sell the commodity at the new schedule of prices until a designated period of time has elapsed.

Price-posting provisions were established in the marketing-agreement programs for Oregon and Washington fresh prunes and for package bees and queens during the 1938–39 season. Price-posting regulations do not purport to exert any direct influence upon prices and grower returns, but are provided for the purpose of indirectly

affecting grower returns through enabling growers and handlers to obtain better knowledge of the market conditions and keeping handlers from undercutting the market before posting notice.

LIMITED USE OF PRICE POSTING

The posting of prices appears to be a reasonable measure if the intent is purely to insure the spreading of market information and not to exert any influence upon the level of market prices. It may be true that a demoralized market can be the result of selling activities of a minority of shippers acting upon information which is not complete or true, and price-posting provisions which prevent this appear to be justifiable. It must be borne in mind, however, that moral suasion exerted upon handlers by price-posting provisions not to reduce prices when prices should decline results in unfavorable repercussions upon growers. Moreover, in the event the market is declining and attempts are made to prevent this decline through encouraging shippers not to post lower prices, the shipper who violates will increase his returns above those of his competitors. Roughly speaking, it appears that price-posting provisions present industry groups with mechanisms whereby some form of price control may be attempted and probably would be attempted in the event of price declines. Economic considerations, however, reveal the futility of effective price control in the absence of volume control.

ALL TYPES EMPLOYED

The foregoing provides a brief discussion of the types of regulations established under marketing agreement programs during the last season and the economic bases of these regulations. It is apparent that regulations relating to volumes and to grades and sizes shipped to commercial markets constitute the two principal mechanisms which are established in marketing-agreement programs for the purpose of improving and maintaining grower incomes.

CONDITIONS VITAL TO A PROGRAM

Experience in regulating shipments indicates that certain conditons must exist in an industry before a marketing agreement program can operate successfully. In the first place, regulations cannot be consistently and effectively operated without thorough appreciation by industry groups of the fundamental principles involved in marketing control. It is not uncommon for some to feel that the very issuance of regulation orders will bring about an increase in price and improvement in grower returns.

Performance of regulations has in no case indicated that the mere existence of regulations increased prices above what would be expected for the volumes and composition of supplies moving to market. It must be realized that to influence returns and prices effectively actual regulation of shipments must be brought about. Moreover, grower groups must recognize the responsibility of growers under orderly marketing programs. The generalization may be made that a marketing-agreement program extends the principle of cooperative marketing to all growers and handlers of the commodity within the area embraced by it.

SHARE IN BENEFITS AND BURDENS

A marketing-agreement program for a crop is instituted for the purpose of bringing about a change in either the volume or composition of supplies shipped to commercial markets. This implies that growers and shippers must relinquish some of the rights which heretofore they had considered to be inalienable, namely, individual determination of the quantity and timing of the sales of their commodity, to an organization directing the marketing of the commodity for the welfare of growers as a whole. It is essential for the continued success of marketing-agreement programs that growers be thoroughly acquainted with the implications of regulation of shipments. In addition to being acquainted with the benefits to be derived from marketing-agreement programs, growers have to understand what obligations they must assume and what rights they must relinquish to some central agency in order to effectuate the purpose of a marketing-agreement program.

CROP ESTIMATES ESSENTIAL

It is extremely important that agricultural industries in which marketing-agreement programs are established be equipped with an adequate crop-estimating service. In some cases crop-estimating systems which have been established by the agency administering marketing-agreement programs have improved greatly upon the crop estimates available for these commodities prior to the establishment of marketing-agreement programs.

It is, of course, obvious that a program of volume regulation cannot be effectively undertaken until accurate estimates are at hand relating to supplies available for shipment. It is essential that crop estimates be made not only for the entire crop but also for whatever districts may be necessary in the event regulation is established by districts. In some instances it may even be necessary to estimate the supplies controlled by individual growers or handlers.

In industries where regulation by grades and sizes is established, there must be estimates of the available supplies by grades and sizes which, furthermore, may have to be made by districts. The crop-reporting facilities of the Agricultural Marketing Service are very helpful in forecasting the total season supplies. The method employed in forecasting, however, does not lend itself to estimating crops by districts, or to providing estimates of the grade and size composition of the crop.

MUST INSURE EQUITABLE TREATMENT

Experience with regulation provisions in marketing agreement programs indicates that more and more emphasis is being placed upon equitable treatment of growers and handlers under regulations which govern shipments. Equitable proration among handlers and growers under volume regulation implies that each handler be given opportunity to ship, during the period of regulation, the same proportion of his total supplies available for shipment during that period as any other handler, and that each grower be given the same opportunity to market his crop as any other grower. Growers are considered to have equitably participated in grade and size regulation

when the proportion of their crop available and intended for shipment which is permitted to be shipped is equal to the average proportion permitted to be shipped in the district in which the growers are located. These definitions indicate the importance of adequate crop-reporting facilities as previously discussed. In addition, these definitions presuppose that the right which is given each shipper to move fruit is related to the total quantity of fruit which he could ship in the absence of regulation.

ALLOTMENTS TO HANDLERS

Considerations relating to the provision of equitable allotments among growers and handlers under volume regulation reveal that allotments should be based upon the control of the commodity currently held by the individuals to whom allotments are given. The issuance of allotments to shippers of citrus fruits last season under the marketing agreement programs varied in form in the different producing areas because of the different institutional framework in the areas. In the California-Arizonia area, nearly 90 percent of the fruit shipped to market was controlled by cooperative marketing organizations. In Texas, on the other hand, cooperative organizations controlled nearly 40 percent of the fruit shipped to market. In California-Arizona, each shipper was alloted each week the proportion of the weekly allotments that the total quantity of merchantable fruit he controlled for the season was to the total quantity of merchantable fruit estimated to be available during the season. Independent shippers, under this formula, were obliged to obtain control of all the fruit they intended to ship during the season at the start of the season if they were to receive their equitable share of allotments for their season shipments.

Under an allotment formula of this nature, the assumption is implied that the shipping pattern of each shipper is identical with that of every other shipper. Roughly speaking, this formula has been successfully operated under the California-Arizona citrus marketing agreement program due in large measure, however, to good administration which, in addition to having consistently provided adequate crop estimates, has been able to provide a degree of flexibility in applying the formula so as to take care of shippers to whom this formula did not apply.

EXPERIENCE IN TEXAS

This type of formula, however, was not applied in Texas because of the fact that around 60 percent of the fruit was shipped through individual operators, a large portion of whom purchased fruit throughout the season and hence did not have control of the fruit until a short time before it was shipped. In order to meet this problem, an allotment formula was provided under which shippers who had control of the fruit were given allotments aggregating the same percentage of the total allotments for the given period as the quantity of fruit which they had under control was of the total crop yet to be shipped. Shippers having control of fruit shared these allotments on the basis of their proportionate share of the fruit under control, while the residual amount was allotted to shippers

who did not elect to receive allotments on the basis of fruit they control. These shippers received their allotments on the basis of their performance during the 1937–38 season.

It is immediately apparent that a proration formula similar to that established in Texas in 1938–39 must be accompanied by accurate knowledge of the volume of the crop yet to be shipped and accurate knowledge of the quantity of the crop controlled by shippers who elect to receive allotments on the basis of the fruit they control. Examination of performance in Texas during the 8 weeks of the 1938–39 season in which volume regulation for grapefruit was in effect indicates reasonable success in maintaining shipper and grower equity, due largely to conscientious efforts on the part of the administrative committee to maintain accurate estimates.

CURRENT CONTROL BASIS FOR ALLOTMENTS

Careful consideration indicates that current control is the most feasible basis for a proration formula under volume regulation. This is particularly true in the event that regulation is designed to effect elimination of some of the crop, for under a dual-base system there would be no accurate check upon operations of an independent shipper who received his allotment on the basis of his past performance. Handlers receiving allotments on this basis need only purchase volumes sufficient to fulfill allotments which have been issued to them, which practices would obviously result in discrimination among growers.

The solution indicated is that of compelling all shippers to contract for tonnage at the beginning of the season and issuing allotments to them on the basis of the volume of the fruit which they control for shipment. This implies a rather advanced phase of cooperative marketing and one which has been achieved in only one industry thus far, namely, the California-Arizona orange industry. This raises the problem of whether the Department should attempt to force this condition upon growers and shippers in the event they indicate their desire to effect volume regulation, or whether the Department should wait until such a condition exists in an industry before volume regulation is permitted to be established. So far, the latter course has been followed.

The problems accompanying equitable allocation of allotments to shippers and growers under volume regulation have been illustrated briefly for citrus fruits since the problem of grower and shipper equity is more vital to regulation in the case of these commodities than in the case of others for which volume regulation was established last year. The problem of equity in the case of walnuts is relatively simple in view of the fact that walnuts are not perishable and must be processed before they are shipped to commercial channels. Allocations to Pacific coast hop growers were made on the basis of estimates of the total crop of each grower.

EQUITY UNDER GRADE AND SIZE REGULATION

The problem of equity among growers in the case of grade and size regulations has been given less consideration than in the case of volume regulation in view of the fact that most of the grade and

size regulations established under the marketing-agreement programs approached stop-loss regulations. It had been determined that shipments of the prohibited grades and sizes would not have returned growers direct harvesting and marketing charges had they been shipped to domestic commercial channels.

With regulations of this nature, it is apparent that the problem of grower equity is not of extreme importance with reference to all growers. Size regulations, however, usually result in appreciable improvement in prices for the restricted sizes, making the shipment of them attractive to the individual grower. Where the crop of an individual grower contains a larger proportion of the restricted sizes than the crops of other growers in his district, he can claim exemption and ship some of the restricted sizes. The problem of equity under grade and size regulations is important in the case of some individual growers, therefore, and safeguards are taken to protect the interests of these individuals.

ROLE OF ADMINISTRATIVE COMMITTEES

The successful operation of a marketing-agreement program depends in no small measure upon the proper functioning of the administrative organization established by the industry. It is essential that the grower and shipper committees be acquainted with data relating to the current position of the industry at all times in order to make proper recommendations to the Secretary for regulations which are to govern shipments.

If volume regulation is established, it is necessary to have data relating to performance of each handler in order to provide for flexible operation of the allotment formula, for any formula in itself is too rigorous for practical use. For grade and size regulation, the committees must have records of the grade and size composition of the crop, by districts. Current data relating to market performance, price behavior, and factors affecting marketing conditions are of course necessary prerequisites for successful performance by the industry committees in administering marketing-agreement programs. The smooth functioning of an administrative organization facilitates transmission of information and recommendations to the Secretary, thereby expediting the issuance of the regulations. In addition, an administrative agency performs the function of acquainting growers and shippers with operations under the program.

GROWER AND HANDLER RESPONSIBILITIES

In summary, it may be stated that regulation of shipments under marketing-agreement programs cannot be established effectively in agricultural industries until there is recognition by growers and handlers of their responsibilities under regulation and thorough understanding of the types of regulation involved. Furthermore, it is essential that adequate crop-reporting facilities are available to provide estimates of the crop necessary to enable successful operation of regulation orders. In addition, the marketing institutions and grower-handler relationships must be such that grower and handler equity will be insured under regulation. Finally, there must be in existence

an efficient administrative organization to facilitate industry performance under regulation.

Experience with regulation reveals that these conditions must be fulfilled before a marketing-agreement program can operate successfully, and that no compromise can be made with these requirements. In the past, some attempts have been made to establish regulation programs where these conditions have not been met. These resulted in unsatisfactory performance—particularly with respect to the maintenance of equity among handlers and growers. It has been recognized, therefore, that a marketing-agreement program requires the existence of these conditions in an industry before it can be effectively established. It is a corollary that regulation programs cannot be adjusted to perform adequately in the absence of these conditions—rather, conditions in the industry must be adjusted to make possible effective regulation under a marketing-agreement program.

BASIS FOR SURPLUS REMOVAL PROGRAMS

While marketing-agreement programs and other similar cooperative industry measures are helping farmers establish more orderly selling conditions for their products, they do not provide the broad and flexible machinery necessary for dealing most effectively with those agricultural problems which arise from reduced consumer buying power, restricted export markets, and the existence of farm surpluses. This additional need is being met by the so-called surplus-removal programs which more properly may be termed programs for encouraging increased consumption and wider market outlets for agricultural commodities.

WHAT THE PROGRAMS DO

During the last fiscal year, the surplus-removal programs played an important role in supplementing the efforts of farmers under the various other phases of the national farm program. These activities helped producers maintain both their incomes and their markets, and, in addition, they made available large supplies of commodities for the use of millions of consumers who lacked adequate buying power. This was accomplished through three principal types of programs: (1) Programs to encourage increased domestic distribution and consumption; (2) programs to divert supplies of commodities from normal trade channels to byproduct uses, and to encourage new uses; and (3) export programs designed primarily to help United States producers maintain their fair share of the world markets for certain agricultural commodities.

LEGAL AUTHORIZATION

Authority for carrying out these activities is provided by section 32 of Public, No. 320, enacted in 1935 and subsequently amended. This legislation makes available to the Secretary of Agriculture an amount equal to 30 percent of annual customs receipts, which may be expended for any of the authorized purposes.

While this and related legislation provide agriculture with additional machinery to deal more effectively with certain phases of the

farm surplus problem on a more or less permanent basis, the legislation is not without precedent. Congress had previously recognized the desirability of making use of supplies of farm products which had accumulated, with ruinous effects on farmers, because of decreased domestic buying power and declining foreign markets. In 1932 and in 1933, for example, Congress directed that portions of the large supplies of Government-held wheat and cotton be made available to the Red Cross for distribution to the needy and distressed. The Agricultural Adjustment Act of 1933 included broad authority for surplus removal and market expansion operations. Legislation in 1934 gave specific authorization for programs of this type for the dairy and beef cattle industries, and provided for the distribution of the livestock products for relief purposes.

CONTINUING POLICY

Through the enactment of section 32, Congress indicated a continuing policy directed at finding ways of encouraging consumption and utilizing farm products so as to avoid ruinous agricultural conditions. Subsequent amendments to this section have defined further the authority of the Secretary of Agriculture and stipulated that funds could be transferred by the Secretary from section 32 to the Federal Surplus Commodities Corporation to be used for the purchase of commodities to be donated for relief purposes A further amendment, enacted toward the end of the last fiscal year, authorized the encouragement of increased domestic consumption among low-income groups and provided for a somewhat broader means of increasing the use of agricultural commodities through indemnity or other payments. At the same time, Congress appropriated $113,000,000 for use in addition to section 32 funds for the 1940 fiscal year.

OBJECTIVES OF THE PROGRAMS

Programs designed to encourage direct increases in the consumption of agricultural commodities operated during the year for nearly 40 different farm products. These activities were carried out (1) by purchasing surplus farm products for distribution to needy families through State welfare agencies, (2) by making available surpluses for use in school lunches, and (3) by the inauguration of the surplus food order stamp plan.

While encouraging consumption of agricultural commodities, the programs sought to relieve growers who were suffering from the price-depressing effects of various types of surplus conditions. In some instances, the surpluses were temporary and local, caused by the lack of a sufficient number of buyers in commercially important producing areas. In other cases, the surpluses were seasonal, arising out of unusual weather conditions which caused the marketing seasons of normally noncompetitive areas to overlap, or because of highly favorable production conditions which sharply increased market supplies. Still other surpluses were due to shifts in domestic consumer demand or loss of foreign markets which required the producers concerned to readjust their operations. Purchases of surpluses in such instances sought to facilitate the readjustment which these producers were to undertake.

PREVENTING WASTE

Through programs for increasing consumption, an effort is made to prevent the physical and economic wastes that take place when producers of perishable commodities are forced to market all of their supplies in a very short time, or when unusually heavy supplies of semiperishable commodities carried over from previous seasons cause large quantities of a crop to go unharvested. At the same time that marketing conditions are improved for farmers, the programs make available large quantities of health-giving foodstuffs for the use of millions of needy low-income families who lack adequate buying power.

HOW PURCHASES ARE MADE

A surplus agricultural commodity is bought by the Federal Surplus Commodities Corporation at the direction of the Secretary of Agriculture, following determination that a surplus condition exists and that a purchase program will aid in correcting the situation. Following a request for assistance from producers, an investigation is made by the Division of Marketing and Marketing Agreements to determine the relative situation of producers of the commodity involved as compared with the situation in previous marketing seasons. It must be clearly shown, by a comparison of the volume of available supplies with the quantities normally marketed, that supplies are large and burdensome and that prices received by producers compare unfavorably with those of recent seasons or with prices during a given reference period. If the results of the investigation show that a purchase program is necessary, a recommendation is made to the Secretary. The recommendation contains information showing the extent of the surplus in the specific commodity; the grade, size, and quality composition of the supply; and the area or areas in which the surplus exists. It also suggests the maximum prices to be paid and the maximum quantities to be purchased. If the Secretary determines that the recommended purchase program is justified, the Corporation is authorized to carry out the program in accordance with his directions.

AIMS IN BUYING SURPLUSES

Certain objectives govern the operation of a purchase program. The primary aim is to improve returns to producers for their entire crop, rather than to improve returns only to the extent of the buying operations. By removing that portion of the supply which most seriously depresses the market, the Corporation endeavors to make possible maximum commercial utilization of the crop. The amount which is bought through a surplus removal program usually represents a very small part of the total production, or available supply, of the commodity. For the most part, it is between 1 and 5 percent of the total; occasionally higher. In some instances, however, merely an announcement of the intention to buy brings about an immediate improvement in the market situation.

TABLE 3.—*Purchases and expenditures by the Federal Surplus Commodities Corporation by commodities, for the fiscal year ended July 30, 1939* [1]

Commodity	Unit	Quantity purchased	Total cost
	1	2	3
Apples, fresh	Bushels	555,584	$596,604
Beans, dry	Pounds	76,409,500	2,090,313
Beans, green	Bushels	33,620	17,854
Beets	Bushels	322,339	135,467
Blackberries, canned	Cases	76,960	134,600
Butter	Pounds	122,286,750	34,704,169
Cabbage	Pounds	118,962,085	1,102,370
Carrots	Bushels	152,102	72,269
Cauliflower	Crates	21,448	17,968
Celery	Crates	30,837	44,242
Corn, fresh	Bushels	17,730	4,606
Corn meal	Barrels	859,918	2,809,601
Cotton, raw baled	Bales	29,190	1,024,418
Cotton containers	Number	197,095	17,650
Cotton ticking	Yards	3,798,441	328,409
Eggs, shell	Cases	107,697	532,134
Grapefruit	Boxes	1,954,533	2,100,333
Mesh bags	Number	649,870	62,625
Grapefruit juice	Cases	2,419,029	2,966,999
Milk, dry skim	Pounds	13,997,211	706,931
Paper bags	Number	13,156,975	92,964
Milk, evaporated	Cases	73,600	172,147
Milk, fluid	Quarts	61,265,821	3,349,251
Onions	Bushels	232,785	168,176
Oranges	Boxes	1,824,279	2,937,792
Mesh bags	Number	460,000	41,958
Peaches, dried	Pounds	10,480,954	772,500
Peaches, fresh	Bushels	5,959	6,924
Pears, fresh	Boxes	295,299	400,552
Peas, fresh	Bushels	2,598	2,808
Plums, fresh	Boxes	32,355	25,269
Potatoes, sweet	Bushels	378,088	193,073
Potatoes, white	Bushels	2,264,499	1,417,929
Prunes, fresh	Bushels	13,743	21,927
Raisins	Pounds	20,199,000	946,814
Rice	Pounds	12,758,000	333,049
Syrup, cane	Cases	36,784	88,182
Tomatoes, canned	Cases	66,701	88,949
Tomatoes, fresh	Bushels	109,237	73,327
Wheat cereal	Barrels	340,015	1,200,573
Graham flour	Barrels	314,996	1,110,585
White flour	Barrels	908,299	3,603,552
Total			66,567,863

[1] Includes transportation, processing, and other handling costs which are subject to some revision. A portion of these costs represent encumbrances for transportation and processing of commodities purchased in the current fiscal year that will be paid in the 1940 fiscal year.

A constant effort is made to see that benefits from purchase programs are not confined to a small number of producers, but that they aid the entire group marketing the commodity. Purchases ordinarily are made in areas producing quantities which are large enough to affect marketing conditions and prices. If this presents practical administrative difficulties, as with butter and eggs, the purchases are made in central markets having national price-determining effects, in order that the benefits of the buying operation may be reflected to the largest possible number of producers who market the commodity.

INDUSTRY COOPERATION

In developing and operating a purchase program, great care must be taken to avoid encouraging uneconomic production. Consequently, the general policy has been to adhere to commercial standards. In most instances, doing otherwise would permit the purchase operations to encourage inefficiencies and unwise expansion of production.

The purchase programs assist industry groups in recognizing the advantages of cooperative action in meeting their marketing problems. The experience of industry advisory committees of growers and handlers in connection with these activities has encouraged growers to continue their efforts toward cooperative action and to formulate marketing agreement or other industry programs designed to bring about more orderly selling conditions for their commodities.

PRODUCTS FOR RELIEF USE

In carrying out the provisions of the authorizing legislation, the commodities bought through the purchase programs are made available to State welfare agencies, which maintain a commodity distribution system in each State. The distribution of these products by the State welfare agencies to those on relief is guided by general regulations issued by the Corporation. Under these regulations, only persons who have been certified to be in need of public assistance are entitled to receive surplus commodities. Surplus commodities are given in addition to any other form of aid so as to bring about a net increase in consumption. The regulations prevent the distribution of commodities in excess of set maximum rates. These maximum rates of distribution have been developed with the cooperation of the Bureau of Home Economics, and seek to supply the difference between what a needy family is able to buy, and what it should have to satisfy its diet needs.

VOLUME DISTRIBUTED

During the fiscal year, the Corporation made available to State welfare agencies over 1,970,000,000 pounds of foodstuffs at a total cost slightly in excess of $66,500,000. These agencies distributed commodities to more than 10,500,000 people. The bulk of this distribution was to needy families on relief whose normal relief grants were insufficient to provide an adequate diet. Besides the States and the District of Columbia, commodities were distributed in Puerto Rico and the Virgin Islands.

Distribution varied widely from month to month, depending on supplies available and case loads in the various States. In July 1938, 115,000,000 pounds of foodstuffs were distributed, while in October 1938, 209,000,000 pounds were distributed. The average distribution during each month was 164,200,000 pounds.

THE SCHOOL LUNCH PROGRAM

One of the most important features of the direct purchase and distribution operations carried out last year was the national school lunch program, which made use of nearly 30,000,000 pounds of the surplus commodities. Under this program, a monthly average of more than 500,000 underprivileged school children in an average of 8,632 schools were served free lunches which were partly or wholly made of the surplus farm products. The program expanded rapidly from the beginning of the school year, and at the peak, lunches were being served in 14,000 schools to more than 800,000 children. Schools in every State, as well as in the District of Columbia, Puerto Rico, and the Virgin Islands, participated.

SOME RESULTS

The school lunch program is a joint project, carried out in cooperation with the Works Progress Administration and local educational, civic, and welfare agencies. All lunches made in whole or in part from surplus commodities are served free.

Records kept in connection with the operation of the program in various schools reveal significant results. Outstanding was the fact that children receiving the lunches showed material gains in weight. In addition, they were absent from school less frequently and had fewer illnesses than before the lunches started.

Definite expansion of the school lunch program was started during the latter part of the fiscal year. It was hoped that the program would be serving 5,000,000 undernourished children by the end of the 1939–40 school year. Such expansion would not only provide health-building lunches for millions of needy children, but would also provide additional outlets for agricultural commodities.

THE FOOD STAMP PLAN

In March 1939, the Secretary of Agriculture announced that the Federal Surplus Commodities Corporation would undertake, on an experimental basis, a new plan for distribution of surplus commodities to needy and undernourished persons. This program, known as the food stamp plan, continued the policy of expanding the domestic market for agricultural commodities by making surplus food products available to families eligible for public aid. As distinguished from the method used in the direct distribution of surplus commodities, however, the food stamp plan utilizes the normal channels of trade.

The program was begun on an experimental basis and the first city selected was Rochester, N. Y., where operations started in May 1939. In June, it was placed in effect in Dayton, Ohio, and plans were made for extension in July to Seattle, Wash.; Birmingham, Ala.; Des Moines, Iowa; and Pottawatomie County, Okla.

HOW THE PLAN OPERATES

The mechanism for utilizing the normal channels of trade in bringing about the increased consumption of surplus food involves the use of food stamps.

In order to get a broad experience record in this new approach, various methods of operation were tried. Basically, however, they all adhered to the same general pattern.

Because the best available figures indicate that persons getting public assistance spend an average of about $1 a week per person for food, safeguards are provided in the plan to insure the continued expenditure of that amount by those eligible persons who participate. Any food, therefore, that is made available to the relief families in addition to what they are already able to get represents a net increase in their consumption The safeguards are in the form of 25-cent orange-colored stamps. Relief families participating in the plan may, on an entirely voluntary basis, purchase orange-colored stamps at the rate of $1 a week for each member of the family as a minimum, or at the rate of $1.50 a week for each member of the

family as a maximum. For each dollar's worth of orange-colored stamps purchased, 50 cents worth of blue surplus stamps, each worth 25 cents, are given free to the family.

Both types of stamps can be used for food in any grocery store in the area in which the plan is operating. The orange-colored stamps can be used for any food usually purchased in grocery stores and also for such items as soap and starch, but cannot be used for tobacco or alcoholic beverages. The blue surplus food stamps can be used only for those food products declared by the Secretary of Agriculture to be in surplus and which are listed on the surplus commodity bulletin currently in effect.

INCREASES BUYING POWER

The blue surplus stamps represent a 50-percent increase in food purchases by relief families. They mean that each member of the family can spend at least $1.50 for food, instead of the $1 which was being spent in most instances before food stamps were available.

This, in essence, is the detail of how the program works, although, of course, there are variations which give the necessary flexibility to meet different local conditions. Thus, in areas where food vouchers were issued to relief cases, no orange stamp purchases were required in order to secure blue stamps, since the food vouchers already covered regular food expenditures. In areas where very little cash relief was granted, blue stamps were issued without any orange stamp purchases. Grocers paste $5 worth of stamps on cards, and deposit them at their banks, which, in turn, receive payment from the Federal Government.

OPERATING HIGHLIGHTS

The food stamp plan continued as an experiment during the remainder of the fiscal year. While a complete analysis of the food stamp plan will require a considerably longer period of operation, initial studies brought out the following facts:

1. Participation of eligible persons, which is on a voluntary basis, increased steadily from the inception of the program.
2. Eligible persons apparently like getting surplus commodities through regular grocery stores. They have experienced little, if any, difficulty in shopping with the stamps. They have bought in quantities to meet their immediate needs, and have expressed satisfaction with being able to select the commodities they want from among the surplus products on the list.
3. Needy persons who have participated in the plan are getting not only a more adequate diet, but, apparently in most cases, a better balanced diet.
4. The increased volume of trade in grocery stores, occasioned by the food stamp plan, has had a stimulating effect on many other businesses in the community.
5. Food sales in Rochester have increased beyond the amount represented by blue-stamp purchases. Aggressive merchandising, advertising, and sales campaigns, as well as special displays, have contributed to this result. The entire food industry has worked together to bring about this broader market for farmers with surpluses to sell.
6. In all instances merchants participating in the plan have received payment for their stamps from the Treasury Department within a few days from the date of acceptance. Banks have cooperated in the redemption of the stamps, as a service for both depositors and nondepositors.
7. Local governmental and public welfare officials have done effective jobs in helping to put the plan into operation, and in assisting in its administration.
8. There have been very few reported violations of the regulations concerning use of the stamps. These cases are either now being investigated or have

already been investigated and appear to have been the result of misunderstanding.

9. The food stamp plan may well develop into an extremely effective national program through which to move surpluses of those agricultural products for which there is an elastic demand.

Studies of the operation of the plan will continue with special emphasis by the Bureau of Home Economics on the dietary effect of the program on families receiving public assistance, and special emphasis by economists of the Corporation on the agricultural significance of the operation of the plan.

OTHER PROGRAMS FOR SURPLUSES

In carrying out programs which deal with agricultural surpluses, there is need for wide flexibility in operations. The market situation and the organization of the industry are different for each commodity. These have to be taken into consideration in each program. The numerous ways in which the operating objectives are carried out are best illustrated by examining in detail some of the principal programs.

PROGRAMS FOR DAIRY PRODUCTS

After a 4-year period of moderate dairy production, improving consumer demand and upward trend in dairymen's incomes, dairy farmers were confronted with a combination of adverse conditions at the beginning of the 1938–39 season. The general business recession had resulted in a decrease in consumer income and buying power. Dairy production recently had shown a marked increase.

During the 1938–39 May–April season, consumer-demand conditions showed only slight improvement. With good pastures, large supplies of other feeds and some increase in milk-cow numbers, dairy production was the largest on record. Production of the principal manufactured dairy products as a group was nearly 10 percent greater than the average production of the preceding five seasons. The farm price of butterfat averaged 24.3 cents per pound, or 73 percent of the parity price.

PURCHASES EXPANDED

To help maintain the incomes of dairy farmers, by diverting part of the price-depressing surpluses of dairy products to relief uses and encouraging a reasonable degree of market stability, the relief purchase programs were expanded and supplemented by a butter-loan program. The operation of the programs was based upon careful consideration of the current and prospective developments during the season in production and supplies, consumer-demand conditions, seasonal and average level of prices, funds available for the programs, and the needs for relief purposes.

The quantities of products removed from the markets under the programs were equivalent to about 6 percent of the total supply of the principal manufactured dairy products as a group, or about two-thirds of the quantity by which the total 1938–39 supply exceeded the average supply in the preceding five seasons. The total 1938–39 supply could have been marketed in regular consumer channels only at a substan-

tially lower average level of prices. The actual level of prices was reasonable from the standpoint of consumers, and consumption of those products in regular trade channels totaled about 4 percent greater than the average consumption in the preceding five seasons. Meanwhile, millions of unemployed and other needy families were greatly benefited by the distribution of surplus products to those on relief and without means of buying such products in the markets.

1938–39 PROGRAM FOR BUTTER

The 1938–39 butter stabilization program represented the first application to dairy products of section 302 (a) of the Agricultural Adjustment Act of 1938, which authorizes Commodity Credit Corporation loans on agricultural commodities under terms and conditions determined by the Secretary of Agriculture and approved by the President. In general, it is impracticable for individual farmers to store their dairy products in order to obtain Government loans on them, as is done in the case of some of the other major crops. However, farm prices of milk and butterfat are based largely upon market prices of dairy products, particularly butter. Accordingly, farmers in general are directly benefited by programs involving purchases of butter in the markets at the basic loan rates and storage under loans.

An agency was needed to help operate the butter-loan program. For this purpose the Dairy Products Marketing Association was organized with a membership of eight regional cooperative marketing organizations engaged principally in the marketing of the butter of many local producer-cooperatives. This was in accordance with the policy of encouraging producers and their representatives to help formulate and operate the agricultural programs. The Dairy Products Marketing Association is a nonprofit, non-capital-stock organization, and its articles of incorporation specify that no funds involved in the program may be distributed to its members as profits or dividends.

FEATURES OF THE PROGRAM

The 1938–39 butter-loan program contained the following provisions:

(1) Commodity Credit Corporation loans to the Dairy Products Marketing Association of up to $33,375,000 for the purchase and storage of up to 115,000,000 pounds of butter, such purchases to be made at prices equal to the basic loan rates;

(2) Loan rates as determined by the Secretary of Agriculture of not to exceed 75 percent of the parity price plus subsequent loan advances for storage and operating costs;

(3) Notes of the Dairy Products Marketing Association, secured by warehouse receipts representing the butter, as collateral for the loans;

(4) Provision that the butter would be available for resale to the commercial trade, but only at prices representing a reasonable seasonal increase, and in no event at less than the purchase prices and all storage and operating costs;

(5) Provision that the butter might be resold to the Federal Surplus Commodities Corporation for relief distribution; and

(6) Provision that, if the sales proceeds exceeded the amount needed to repay the loans and for operating costs, such excess funds would constitute a reserve to be used for future operations or turned over to the Federal Surplus Commodities Corporation in the form of dairy products for relief distribution.

HELPED MARKET SITUATION

The program represented a means of discouraging a decline in prices, during the summer pasture period of large farm production, to unduly low levels in relation to the prospective supply, demand, and price conditions for the storage season as a whole. The resale provisions represented an assurance to producers and to those in the trade who stored butter that the stocks held under loans would not interfere with a reasonable seasonal price increase. At the same time, they represented an assurance to consumers in regular trade channels of an adequate reserve supply at reasonable prices if production fell off to less than usual during the winter.

Under the 1938–39 program, the Dairy Products Marketing Association began purchasing butter in mid-June and, mostly during July, August, and September, purchased 114,137,000 pounds of 89- to 92-score butter. Most of this butter was purchased on the basis of 25.5 cents per pound for 92-score butter at Chicago, with the usual price differentials for other grades and markets. The butter was purchased largely on the New York, Chicago, and Pacific coast mercantile exchanges, although some open-market purchases of car-lots of butter in storage were made in the central markets, as well as at various other points, on the basis of the central market prices less freight. With record levels of dairy production, commercial supplies continued large and prices showed little seasonal rise. In September 1938 the Dairy Products Marketing Association began selling the butter to the Federal Surplus Commodities Corporation for relief distribution, applying the sales proceeds on the loans. By the end of the fiscal year, such sales had totaled slightly over 96,000,000 pounds. The 1938–39 loan program involved loans totaling approximately $31,500,000. The outstanding balance of the loan at the end of the fiscal year was a little over $5,500,000 on slightly under 18,000,000 pounds of butter.

DIRECT PURCHASE ACTIVITIES

During the year, the Federal Surplus Commodities Corporation purchased for relief distribution 122,000,000 pounds of butter, about 3,000,000 pounds of evaporated milk (excluding 19,000,000 pounds acquired in exchange for fluid milk purchased under the New York diversion program), 14,000,000 pounds of dried skim milk, and 134,000,000 pounds of fluid milk, at a total expenditure, excluding administrative costs, of over $35,000,000 of the funds made available by section 32.

The Federal Surplus Commodities Corporation purchases included 96,000,000 pounds of butter bought from Dairy Products Marketing Association and 26,000,000 pounds purchased in the markets during the winter. These Federal Surplus Commodities Corporation market purchases also were made on the basis of 25.5 cents per pound for 92-score butter at Chicago.

With commerical storage stocks of butter reduced to about the usual small volume for that part of the season, and in view of the limited funds available for the relief purchase programs, the Federal Surplus Commodities Corporation purchases in the markets were suspended on March 8, 1939, pending more definite indications of prospective supply and demand conditions in the coming season. While no further purchases of butter were made in the markets during the remainder of

the fiscal year, the Federal Surplus Commodities Corporation continued to take over butter from Dairy Products Marketing Association for relief distribution. The rate of relief distribution of butter was increased during the fall months of 1938 to about 12,000,000 pounds per month.

BUTTER AND OTHER MILK PRODUCTS

Careful attention was given to the advisability of purchasing cheese and evaporated milk for relief distribution during the 1938–39 season. In midsummer 1938, when supplies of all dairy products were extremely large, cheese prices temporarily were somewhat low relative to butter prices, and numerous requests were received for relief purchases of cheese. However, it was important from the standpoint of the whole dairy situation that provision be made for taking over for relief purposes the butter being placed under loans. Since a curtailment of the butter stabilization activities and a decline in butter prices undoubtedly would be accompanied by further declines in prices of other dairy products, it appeared inadvisable at that time to shift the use of the limited funds available for relief purchases.

Cheese prices increased in September, and during the remainder of the season were fully in line with butter prices. Evaporated milk prices were fully in line with, or relatively higher than, butter prices throughout the season. With a large quantity of butter on hand for relief distribution at the beginning of the 1939–40 season, consideration was given to the possibility of further relieving the general dairy surplus situation by diverting some cheese and evaporated milk to relief outlets, provided this could be accomplished at an expenditure about equal to the cost that would be involved in purchasing an equivalent volume of butter in the markets. In response to invitations sent to manufacturers, offers were received by the Federal Surplus Commodities Corporation in June 1939. The prices in the offers of cheese were relatively higher than prices of other dairy products and none of them were accepted. However, 3,262,500 pounds of evaporated milk were bought.

Dried skim milk supplies were large and prices extremely low last season. During the fiscal year, Federal Surplus Commodities Corporation purchased nearly 14,000,000 pounds. Relief distribution of this product in recent years not only has provided needy families with an important food from the dietary standpoint, but also has tended to introduce the product for home use and to develop a potential demand for it. Dried skim milk production and supplies have decreased in recent months and prices have improved considerably.

Butter has been designated as a surplus commodity under the food stamp plan. Preliminary results in the few cities where the plan has been operating have indicated that a substantial proportion of the surplus food stamps have been used by relief families for purchases of butter. Expansion of the plan may result in the purchase of a substantial quantity of surplus butter through regular trade channels by relief families receiving the stamps during the 1940 fiscal year.

DAIRY PRODUCTS PURCHASE METHODS

Under the programs, the purchases of dairy products surpluses have been made in such form and by such methods as promised the

maximum immediate effect on returns to producers of milk and butterfat in general. The market for manufactured dairy products, to a large extent, is Nation-wide, and there are rather high degrees of interproduct and interregional supply and price relationships. Over a period of time purchases of one product tend to affect the supplies and prices of all dairy products. In general, it has appeared advisable to operate the programs so that the maximum quantities of surpluses in terms of milk equivalent would be removed with a given expenditure. Other important considerations have been the prevailing trading practices, the importance of quick action, and of immediate effects of the purchase activities on returns to producers, and the administrative costs.

For several reasons, the surpluses removed under the programs have been largely in the form of butter, which, in terms of quantity of milk used, is the leading manufactured dairy product. Farm prices of butterfat and milk used for dairy products are based largely on market quotations for butter. Purchases of butter may be readily made on a daily basis, with the benefits immediately reflected in returns to producers. Furthermore, variations in butter prices are likely to be accompanied by corresponding variations in prices of other dairy products. The removal of surpluses in the form of butter tends to relieve the pressure of large milk production on supplies and prices of other dairy products. However, supplementary purchases of other dairy products have been advisable at times when the supplies and prices of those products have been considerably out of line with butter supplies and prices.

THROUGH EXCHANGES

The rules of the mercantile exchanges provide that transactions may be made on the exchanges only by its members. They also require payment of specified commissions and certain other fees. Federal Surplus Commodities Corporation purchases of butter in the exchanges have been made through cooperative-marketing associations who are members of the exchanges, the cooperatives making the purchases for Federal Surplus Commodities Corporation under purchasing agreements and in accordance with daily directions. In using the services of the cooperatives, it has been felt that, if the commissions and fees exceeded the actual costs incurred by the cooperatives in performing the services, such excess would go to producers. This would be consistent with the primary purposes of the programs.

OFFERS OR BIDS

In recent years, purchases of cheese, evaporated milk, and dry skim milk have been made on the basis of offers or bids submitted by manufacturers and handlers in response to distributed announcements that offers or bids would be considered. While this method generally requires more time than the exchange purchase method, quick action usually is not so important in purchasing those products as in purchasing butter. The offer or bid method has the advantage of making possible purchases of the products in the producing areas for direct shipment to the points of relief distribution. This method also makes it possible for manufacturers to offer surplus stocks to

Federal Surplus Commodities Corporation at prices below the prevailing market prices, thus assisting the diversion to relief outlets of relatively large quantities of surpluses with the available funds. This has been accomplished under the evaporated milk and dry skim milk purchase programs.

In carrying out the surplus removal programs for dairy products, the objective is to buy in such a manner as to get the greatest effect for every dollar spent. Experience has shown that this can best be accomplished through concentrating buying operations on butter. However, from the general industry standpoint and from the broader objective of encouraging consumption of dairy products, it is necessary to supplement butter buying operations with purchases of other dairy products. In this way it is possible to maintain a better balance within the industry and, at the same time, distribute for relief use various kinds of dairy products.

RELIEF MILK DISTRIBUTION PROGRAMS

Until recently, only manufactured dairy products such as butter, evaporated milk, dry skim milk, and cheese were bought under surplus removal programs. Late in 1937, however, a program involving the purchase of fluid milk for relief distribution to supplement operations under the marketing order for the Boston milk market was inaugurated. This program has been in effect since that time. The successful operation of the program has depended upon the cooperation of producers, handlers, and municipal authorities.

At the time the program was inaugurated, data showed that there was an outlet in the Boston area which, if reached, could increase fluid milk sales substantially. Such a program, it was felt, would serve definite purposes. In the first place, it would bring into use at higher returns substantial quantities of milk which producers had been selling for cream and manufactured purposes with lower returns. In the second place, the operation of such a program would make available additional supplies of milk to many needy families, and quantities of milk to other needy families who were unable to get any milk because of their inability to buy. And, of course, from the standpoint of the handlers, the operation of the program would mean a larger volume of milk running through their plants.

OPERATIONS IN NEW ENGLAND

Under the program operations, starting in October 1937, milk was bought and donated to the welfare agencies in the Boston area and in Manchester, N. H. During the year, over 62,000,000 pounds of milk were made available under this program, bringing the total amount distributed to over 89,000,000 pounds.

The Federal Surplus Commodities Corporation conducted the purchasing operations involved in the program. Handlers and associations of producers desiring to sell milk to the Corporation were required to submit offers for this purpose. Acceptance of these offers, specifying the terms upon which supplies were offered, constituted the contractual arrangement under which milk was obtained. Prices paid by the Corporation for milk purchases were the class 1 prices established by the Federal order regulating the handling of milk in

the Boston marketing area. Contracts with sellers called for the delivery of milk containing not less than 3.7 percent of butterfat. All milk was purchased in bulk.

Milk purchased under the program had to conform to the sanitary and health regulations which are applicable to milk which is sold for fluid consumption in the Boston marketing area. In addition to the regular inspection by local authorities to which all milk sold in the Boston area is subject, milk obtained under the program was inspected by agents of the Corporation to determine each supplier's compliance with contract specifications.

Donation of the milk to local relief agencies in the city of Boston and in the surrounding communities constituting the Boston milk marketing area, for distribution to needy families, was effected at the point of purchase. Relief agencies financed the handling and distribution of the milk thereafter, except for such quantities as were distributed to Works Progress Administration families, who were charged two cents per quart to cover the cost of processing. Processing services covering pasteurization, bottling, and delivery to distributing stations were performed by handlers who were complying with the Boston order, among whom the supplies were allocated for this purpose. Processors received from 1¾ to 2 cents per quart for these services.

DISTRIBUTION SAFEGUARDS

The bottled milk was distributed to needy families in the Boston milk-marketing area from approximately 100 distributing stations operated by the relief agencies with Works Progress Administration labor. Needy families were furnished milk cards authorizing them to receive their allotment of milk free at these stations. As a condition for this, each recipient was required to sign an affidavit pledging to continue the regular purchases of milk, the amount of which was stated in the affidavit. This was designed to assure that the program would not interfere with regular commercial sales of milk in the area. While toward the close of the fiscal year the distribution of milk averaged 70,000 quarts per day, the peak of distribution was during the last half of December 1938, when it averaged 127,000 quarts per day.

MILK PURCHASES IN THE NEW YORK AREA

During the months of November and December 1938 a fluid milk purchase program was instituted in the New York milk-marketing area, as a result of the large output of milk which occurred at that time. Purchases were made from country plants equipped to handle only fluid milk. Supplies purchased were delivered to manufacturing plants, where they were converted into products which could be utilized for relief distribution. This program supplemented operations under the Federal-State orders regulating the handling of milk in the New York metropolitan marketing area.

Milk from 121 receiving stations was handled in 35 processing plants. The use classification of such diverted milk determined the price paid for the milk, plus 23 cents station handling charge, and plus the hauling charge, dependent upon the proximity of receiving station to the nearest available processing plant under con-

tract. The milk products were distributed in 23 States and the District of Columbia by the Federal Surplus Commodities Corporation. Under this program, also, some fluid milk was distributed to New York schools. The milk was provided in bulk and was served to children of families who were in need of milk to supplement their usual diets.

A little over 72,000,000 pounds of milk were purchased, of which more than 680,000 pounds were distributed to 550 schools in the five boroughs of New York City. The milk bought was produced by dairy farmers in the States of New York, Pennsylvania, and Vermont.

ORANGE AND GRAPEFRUIT PURCHASES

Production of few commodities has changed as rapidly as that of oranges and grapefruit. Practically without exception there has been a large, regular increase in the size of the total crop for market year after year. Since most of the groves are still below their peak bearing capacity, the prospects for increasing production continues. Changes are striking when compared with conditions only a few years ago. The 1938–39 crop of grapefruit was nearly 43,000,000 boxes. This was almost 12,000,000 boxes, or 38 percent, over the 1937–38 crop and 26,200,000 boxes, or 156 percent, over the 1927–36 average. The orange crop, with a yield in the United States of 77,800,000 boxes for 1938–39, was only slightly greater than that of 1937–38, but it was 28,200,000 boxes, or 57 percent, over the 1927–36 average of 49,600,000 boxes.

Even with rising consumer income, the increased supplies to be marketed have depressed prices, and frequently supplies were so great that all of the crop could not be shipped. The bare costs of picking, packing, and shipping could not be obtained for many grades and sizes of fruit.

The industry in Florida, Texas, California, and Arizona sought to improve prices by Federal marketing agreements. At the same time, extensive purchase programs were undertaken both to relieve market pressure, and thus improve prices, and to salvage a part of the supplies that would not have been marketed otherwise.

Grower representatives of the citrus industry met with Department officials in the fall of 1938 to develop a purchase program as a supplement to their own marketing efforts. It was recognized that, even with extensive purchases for relief distribution, supplies, especially of grapefruit, were so great that all of the crop could not be marketed. Diversion of supplies from regular channels of domestic trade into byproducts, such as stock feed, fertilizer, and exports, was suggested and applied by the industry as an accompaniment of the purchase program.

METHOD OF PURCHASE

Each week the Federal Surplus Commodities Corporation offered to buy grapefruit and oranges at prices determined by the commercial market for comparable grades and sizes. Frequently the commercial price for such fruit fell to extremely low levels. Many of the shipments to terminal markets did not return enough to pay hauling, packing, freight, and handling charges. The Federal Surplus Commodities Corporation established minimum levels of prices, at which

it would purchase, which were sometimes, for the reason just given, above the going market.

Orange purchases during the fiscal year included about 796,000 boxes in California and 209,000 boxes in Florida. For most of the Florida season, prices were sufficiently high to permit free movement of practically all of the crop. Consequently, relatively small purchases were made in this State. The California commercial crop was substantially reduced by a severe windstorm in the spring of 1939. While this resulted in somewhat higher Florida prices than might have been expected otherwise, it greatly increased the California marketing problem.

Grapefruit purchases constituted the most substantial undertaking for the citrus industry during the 1938–39 crop year. In all, more than 3,300,000 boxes of grapefruit were bought under the program.

Grapefruit purchases were heaviest during the latter part of the season. At first the fruit was bought and shipped in fresh form. Later, the grapefruit was processed into grapefruit juice through a plan of competitive bidding by canners.

VEGETABLE PURCHASES IN FARMERS' MARKETS

During the first 3 months of the fiscal year, the Federal Surplus Commodities Corporation conducted a vegetable purchase program in farmers' markets situated in urban areas throughout the Northeast and North Central States. Purchases were made in 30 city markets located in Connecticut, Massachusetts, New York, New Jersey, Pennsylvania, Ohio, Michigan, and Minnesota. In all, approximately 556,000 bushels of eight commodities, including principally snap beans, beets, cabbage, carrots, celery, and tomatoes, were purchased at a total cost of $295,700.

Commercial production of truck crops in the United States increased sharply in 1938, continuing the previous upward trend. In the areas where the purchases were made, the reported 1938 supplies were about 45 percent above the 1937 total. Local truck crop production, which is not officially estimated, was also reported to be extremely high. Prices being received in the farmers' markets in early July 1938 were one-quarter to one-third of the 1933–37 average for July.

The purchase program began in the eastern markets early in July and continued until the first part of September. Most of the midwestern activities began early in August and continued throughout September. Purchases were made at prices closely following the commercial market. Ordinarily, an attempt was made through the buying operations to absorb the quantity in excess of daily market requirements. Growers and marketing officials, through their recommendations, assisted in operating the program in each market.

GRADING ENCOURAGED

In carrying out the purchase program, in the farmers' markets, efforts were made to bring about permanent improvement in the grading, packing, and packaging of locally grown produce. In this way it was hoped to overcome the handicap under which local produce had suffered as compared with the higher quality, better-packed

products from commercial producing centers. Accordingly, produce offered for sale to the Federal Surplus Commodities Corporation had to meet grade requirements. Free inspection service on the sales was supplied as a further inducement. As a result of this program, and the efforts of cooperating agencies, much improvement in grading and packaging, as well as some standardization of containers, was reported in a number of the farmers' markets.

OTHER PURCHASE ACTIVITIES

Among the other major purchase programs were those for potatoes, cabbage, corn, wheat, cotton, and eggs. Purchases of surplus potatoes, made during the year in the major producing areas, exceeded 2,000,000 bushels. Approximately 59,500 tons of surplus cabbage were bought in 14 States and distributed for relief use in practically every State of the country. Corn was bought in the form of corn meal through bids from millers. Nearly 860,000 barrels, equivalent to about 3,600,000 bushels of corn, were bought and distributed for the use of needy families. The purchases of wheat were in the form of wheat flour, graham flour, and wheat cereal, of which more than 1,500,000 barrels, the equivalent of over 6,400,000 bushels of wheat, were bought for relief distribution.

Cotton bought under the program was used for mattresses and bed clothing through arrangements with various State relief agencies in cooperation with the Works Progress Administration. Purchases made during the last year approximated 29,000 bales of raw cotton and over 3,000,000 linear yards of mattress ticking, representing around 2,700 additional bales of raw cotton.

More than 100,000 cases of surplus eggs were bought during the year. These eggs were purchased during periods of seasonally heavy production when prices to producers were declining rapidly. The effect of the egg-buying activities was to strengthen producers' prices during the most critical times of the year. Eggs bought were distributed for relief use in practically every State.

THE DIVERSION PROGRAMS

Efforts to encourage wider uses for agricultural commodities are also carried out through so-called diversion programs. A wide range of farm products is being utilized under a number of different diversion programs designed to aid farmers in obtaining outlets for their products in other than normal channels of trade.

WIDER USES FOR COTTON

The programs for cotton and peanuts are significant in this respect. Numerous tests are being made to discover new and wider uses for cotton. One of the programs is designed to encourage the use of cotton as a covering for cotton bales, replacing jute bagging, the raw material of which is imported mainly from India.

Several other programs for cotton during the last fiscal year sought to develop new uses for the product, principally in various types of construction. Similar programs had been in effect during the two previous fiscal years. Under these programs the use of cotton is being

tested in the construction of highways, airplane runways, houses, and as a lining for ditches and reservoirs to check water seepage.

IMPROVED PEANUT MARKET

The diversion program for peanuts supplements the efforts of growers to improve marketing conditions, by aiding them in diverting surplus peanuts from the regular edible trade channels to byproduct uses. Under the program, cooperatives buy peanuts from growers at stipulated prices, and the peanuts are available for resale at slightly above the purchase price. Peanuts which are not resold to the regular trade are crushed and diverted into peanut oil and meal. On the peanuts crushed, the cooperatives are reimbursed under the diversion program for the difference between the price paid growers, plus handling charges, and the byproduct, or oil and meal value.

OTHER DIVERSION PROGRAMS

Among other programs in effect during the last fiscal year were those for the diversion of surplus tobacco to nicotine and other uses, the diversion of surplus sweet potatoes to starch, and the diversion of substandard dried figs and substandard prunes to byproducts. Wider outlets for walnuts and Pacific coast pears were also sought through diversion programs.

THE EXPORT PROGRAMS

Efforts to help United States farmers maintain their fair share of world markets for certain commodities were made through export programs.

In August 1938 the Secretary of Agriculture announced that a program would be instituted to encourage exports of United States wheat and flour. This was to be accomplished through the purchases of wheat in the domestic market and sale of this wheat to exporters at prices which would enable them to meet world competition. Payments were made for flour exports on the basis of differences between domestic and export flour prices. The Federal Surplus Commodities Corporation handled the operations of the wheat export program.

The program was developed to maintain a fair share of world trade for the United States and, along with other programs, to improve wheat prices. With record world supplies of wheat, including the third largest crop in the United States since 1915, increasing barriers to world trade, and numerous devices in effect to support or subsidize export trade in competitive countries, it was certain that United States export trade would be very limited and domestic prices greatly depressed, without Federal support.

The Federal Surplus Commodities Corporation set up regional offices for the purchase and sale of wheat for export. Trade members made daily offers to buy and sell. On the basis of the current market, domestically and abroad, daily offers could be accepted or rejected.

The principal effects of the export program appear to have been to maintain for the United States a fair share of the world wheat market, to reduce the potential carryover of United States wheat, and to increase the prices received by United States wheat producers.

In addition to the export program for wheat, other programs sought to encourage the export sale of high-quality cotton being produced in one-variety communities, to develop new foreign markets for pecans, to aid exports of walnuts, and to encourage butter exports to the Panama Canal Zone. Still another program was designed to recover, for United States dark-type tobacco producers, certain foreign outlets which had been rapidly curtailed.

AGREEMENT AND SURPLUS REMOVAL PROGRAMS OPEN THE WAY FOR COOPERATIVE ACTION

Marketing agreement- and surplus-removal programs provide the means for farmer-industry-Government cooperation in dealing with agricultural-marketing problems. They can also supply the framework through which more effective working relationships between producers and handlers may be established. In the operation of these programs, each group, whether it be of producers or of handlers, must recognize its responsibility to the others and to the general public. The programs by themselves can offer no more than an industry is willing to put into them. They are not a cure-all for farmers' marketing problems but, if used wisely, they can go far in solution of these problems.

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REPORT OF THE DIRECTOR OF PERSONNEL, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF DIRECTOR OF PERSONNEL,
Washington, D. C., June 30, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: Herewith I submit a report of the work in the Office of Personnel for the fiscal year ended June 30, 1939.

ROY F. HENDRICKSON, *Director.*

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INTRODUCTION

Personnel management in the Department is deeply grounded in the objectives of the work program which has been assigned by Congress. It takes into account a great variety of functions and of organizational units. Personnel policies and activities permeate administration in all agencies of the Department, whether they are engaged in research, regulatory work, educational programs, administering grants in aid, action programs, staff functions, or combinations of these functions. The employees which the personnel program must reach are engaged in hundreds of professions and occupations scattered throughout the United States and many foreign countries. The Office of Personnel operates under a variety of employment authorities, and its program must be adjusted to a wide range of employment conditions.

Control of personnel matters is largely vested in the Secretary, who delegates much of his responsibility to the Office of Personnel. This Office in turn emphasizes the greatest possible delegation "down the line," which necessitates the creation and development of strong

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personnel offices in each of the bureaus—strong in the sense that they will be directed and adequately staffed by persons fully qualified to assume increasing responsibilities for all phases of personnel administration, executed within a framework of general policy and coordination applicable to the entire Department. Progressive personnel administration is effective only insofar as its policies and programs are translated into action by intelligent supervision. It is through their contacts with individual supervisors that bureau personnel officials are in a position to bring about a greater appreciation and understanding of the personnel phases of day-to-day management.

The Office of Personnel is primarily a leadership unit with functions which are in part advisory, in part service, and in part regulatory. It seeks to accomplish its functions through leadership by coordinating and correlating processes rather than through the exercise of controls vested in it. Its work must be carried on in close cooperation with the bureaus on the one hand and with the Civil Service Commission on the other.

Personnel management seeks first of all to obtain the maximum utilization of our human resources for the most effective execution of the Department's work program. Secondary to this economic objective is the social objective of employee contentment and achievement. These two objectives are wholly compatible, for wholesome personnel relationships play an important part in the ability of the Department to fulfill its obligations to the public.

In its recruitment activities, personnel management must be geared to compete with private enterprise for its quota of the most highly trained intelligence available. It must formulate conscious policies with respect to training, with respect to salary administration, with respect to creating incentive, with respect to handling suggestions and grievances, and with respect to employee organizations and the relationship of management to such organizations. It must be actively engaged in programs to promote employee safety, to develop health of mind and body, and to safeguard the merit principle.

While many long-time objectives have not been attained, significant progress was made during the fiscal year in broadening the field of personnel activities and in analyzing and more adequately meeting the needs of officials and employees in personnel matters.

PERSONNEL RELATIONS

The rapidly expanding functions of the Department, with the corresponding increase in personnel during the past few years, have emphasized the growing need for an adequate and uniform policy governing personnel relations. Obviously many questions and problems arise affecting an employee's relationship to his job and to those who direct his activities, and good administration cannot afford to ignore these problems nor neglect to make a sincere effort to solve them. It is essential that employees have access to responsible administrative officials for the discussion of individual problems affecting their status and welfare, and that uniform, fair, and orderly procedures should be established and followed, for the consideration and disposition of these problems is consistent equally with efficient administration and the desire of the employee.

In order to meet these needs and as the initial step in the program, a Personnel Relations Section was established, which devotes its attention exclusively to employee grievances, complaints, and other matters affecting employee relations in the Department. As the second, but no less important step, the Department, on May 4, 1938, issued Memorandum 753, in which—for the first time in the Department's history—a personnel-relations policy and procedure was clearly stated.

Memorandum 753 first expresses a general policy and then it provides that employees who so desire are free to avail themselves of informal discussions with officials as a means of making known their views. Every employee is informed of his right to join or refrain from joining any organization or association of employees; and under no condition will affiliation or nonaffiliation with any organization have any bearing whatsoever on appointments, transfers, promotions, or retention in the service. The right of an employee to designate a representative of his own choice to confer and consult with departmental supervisory personnel on his behalf is also recognized; and freedom from discrimination, restraint, interference, coercion, or reprisal is guaranteed.

The right of an employee or his representative to obtain information with respect to rules and regulations governing personnel administration in the Department and with regard to appeals procedure is expressly recognized. An employee, in seeking such information, is expected to proceed through regular supervisory channels by first consulting his immediate supervisor, proceeding then through the unit, section, or division head, as the case may be, to the head of the bureau or agency in which he is employed, and finally to the Director of Personnel. Supervisors are instructed to comply with these requests for information or, if unable to do so, refer them to the officer to whom they are administratively responsible. An employee may, however, proceed directly to his supervisor's superior if he has reason to believe that his supervisor is unable or unwilling to supply the information desired.

The memorandum outlines a procedure for presenting and appealing employee grievances. Any complaint or grievance involving working conditions, promotion, transfer, and similar matters, or growing out of the interpretation or application of rules and regulations governing personnel administration under which the Department or any bureau or subdivision functions, in which existing law permits of administrative discretion, may be presented and appealed by the employee or his representative through supervisory channels up to and including the chief supervisory officer concerned. If the grievance cannot be satisfactorily adjusted through supervisory channels, the appeal may be made to the chief or administrator of the bureau or agency to which the employee is assigned, who will attempt through conference, to obtain informally a prompt and satisfactory judgment.

In the event this effort fails, but in any case at any time that the employee who is appealing elects, the chief or administrator shall proceed to organize a board of three members, one each to be selected by the employee and the bureau. These two members select a third impartial member. This board is authorized to hear witnesses and

make findings of fact and recommendations for disposition of the case to the chief or administrator. If the employee is dissatisfied with the resulting decision, he may appeal to the Director of Personnel, who, failing to reach a satisfactory adjustment in conference with the employee, will proceed to organize a second board of three members. This board is authorized to review the record of the case, investigate the facts, and hear witnesses as necessary. The board's findings and recommendations are taken into consideration by the Director of Personnel in making his decision. Appeals from the decision of the Director of Personnel may be presented in writing to the Secretary of Agriculture.

Finally, the memorandum extends to any employee, or his representative, the right to inspect his job classification sheet.

In shaping this policy and procedure, democratic methods were employed at all times. The first draft was prepared by a staff member of the Office of Personnel. In a series of conferences extending over several weeks, groups of persons representing all major segments of interest were given an opportunity to offer suggestions and criticisms. Among those participating were chiefs of bureaus, representatives from the local Government employees' unions, heads of three national Government employees' organizations, directors and administrators in the Department, and a group of employees selected without regard to affiliation or nonaffiliation with any organization. The final draft was the combined efforts of all those mentioned and carried their final approval.

During the year, 7 bureaus and offices organized boards of appeal which considered 19 employee grievances under the above procedure. Ten decisions, based upon the recommendations rendered, favored the employees, and 8 sustained the bureaus in their original actions. One case was adjusted through transfer of the employee to other work. Thirteen of these cases originated in Washington and 6 in the field service. In addition, the great majority of grievances and complaints from employees were satisfactorily settled by bureau officials through informal discussions with the employees concerned. Efficiency ratings, alleged improper job classifications, allegedly unwarranted discrimination, contemplated terminations, promotions, and working conditions comprised the chief bases for grievances.

There is definite indication that as employees become more familiar with the privilege offered them under the memorandum, they are making greater use of this means to adjust those grievances which otherwise could not be or had not been satisfactorily settled.

IN-SERVICE TRAINING

THE TRAINING COMMITTEE AND TRAINING PROGRAM

The Secretary of Agriculture, on July 25, 1938, appointed a committee on in-service training, with the Director of Personnel as chairman, to codify existing Department policy affecting employee training and education and to outline a desirable program for future development. With the benefit of the advice and valuable suggestions of interested individuals, the Civil Service Commission, the Office of Education, chiefs of bureaus and offices of the Department, and associations of Government employees, the results of the study

were published under the title, "Employee Training Policy." It discusses (1) training in administration and supervision, (2) professional, scientific, and technical training, (3) training in office and manual skills, (4) postentry education, and (5) preentry education. Policies, objectives, and recommended methods and techniques are set forth for each type, laying a broad foundation for a comprehensive departmental training program.

In defining training objectives, the committee states:

> The direct purpose of employee training is to increase the efficiency of the Department. While increased satisfaction and earning power for the employee may result, it is incidental to this primary objective.

The Department's activities in the field of training at the present time are based upon the committee's report.

In the Department of Agriculture training is a line responsibility of technical supervisory and administrative personnel. Training activities are carried on either directly by a supervisory official for his immediate subordinates, or by special instructors selected from functional staff offices of the bureaus and agencies of the Department, or by instructors from other sources. In every case the instructor is thoroughly familiar with the subject he is teaching.

Training activities carried on within the bureaus and agencies of the Department are of four kinds. (1) Breaking in new employees assigned to new jobs; (2) increasing the efficiency of experienced employees in the performance of their regular duties; (3) assisting employees to prepare themselves for advancement by continuing their academic education outside official hours; and (4) training or education in the functions and procedures of the bureau, conducted for employees of other Government agencies—Federal, State, county, or municipal.

It is recognized in the Department that while employee training must be decentralized to get best results, training is only one of many duties of administrative and supervisory personnel, who not infrequently have limited knowledge of the technical aspects of employee training. For this reason the Department has staff specialists at various administrative levels to help plan employee training, to provide the continuity and service which is necessary to assure effective work, and to assist in evaluating results, to teach scientific training methods to executives, and to advise with respect to programs and methods.

At the beginning of the year a small section of training technicians was established in the Office of Personnel. Positions have also been set up for staff officers with full-time responsibility for training and related activities in the Washington offices of the Farm Security Administration, the Forest Service, the Soil Conservation Service, the Weather Bureau, the Office of Extension Service, the Federal Crop Insurance Corporation, and the Agricultural Adjustment Administration. The Forest Service and the Soil Conservation Service have training officers in their regional offices, and several other bureaus have staff employees in regional offices who devote part of their time to employee training.

The Office of Personnel is responsible primarily for providing consulting service on training and educational matters to the supervisory and administrative personnel of the Department. For those

bureaus that have staff-training offices, this assistance is rendered through the staff-training officers. For the bureaus without staff-training offices, the service is provided directly for line officials. During the year assistance was given in planning and conducting about 60 training programs for these agencies. Also in several cases it was necessary to plan and conduct directly interbureau training programs in over-all Department functions, policies, and objectives for selected groups of division chiefs and other employees who, because of the nature of their work, needed such training. Handbooks and manuals on various aspects of training and education were prepared as needed and distributed to the supervisory and administrative personnel of the Department in Washington and in the field. The Office of Personnel has also cooperated with the staff-training officers in bureau and regional offices in the preparation of handbooks for limited distribution in one bureau or region.

Training activities are decentralized, and each separate program is designed to meet a specific situation. In the most recent survey of training programs, some 300 training projects were reported, excluding educational programs, currently in operation. Emphasis has been placed on training for supervisors of all grades in the broader aspects of Department policy and administration and on special training for scientists and technicians.

As a result of the increase in the number of training technicians, carefully planned and organized training activities, and a recognition of the importance of training in the various programs of the Department, considerable progress has been made in employee training, with increased benefits both to employees and to the Department.

THE GRADUATE SCHOOL

Educational courses are offered after official hours for Washington employees by the Department's Graduate School. The school was organized in 1921 by Secretary Henry C. Wallace, as an unofficial agency to provide facilities for continued education to Department workers. This use of government facilities was authorized by Congressional acts, subject to such rules and regulations as the heads of departments might make.

The work has been organized and supervised by officials of the Department, but operation costs have been paid from tuition fees set as near as possible to cover the cost. The general program of the school is approved by an administrative committee appointed by the Secretary under the chairmanship of the Director of Personnel.

Many undergraduate as well as graduate courses are offered. During the year 1938–39 about 130 courses were offered, and there were approximately 4,400 registrations representing approximately 3,000 individuals.

The Civil Service Commission gives full credit for the courses taken, and the credits are also accepted by practically all colleges and universities.

That the opportunities offered by the school are appreciated is evidenced by its growth from year to year. The courses given are those in which groups of workers express interest or which the administrative officials of the Department request.

OTHER POSTENTRY EDUCATION

The success of the employee-training program must depend in large part upon the determination of employees to train for more efficient service and to qualify for advancement to positions of greater responsibility. There is much evidence of this determination among large numbers of Department employees. Numerous efforts are being made to improve on qualifications both through formal and informal education and training.

A very considerable proportion of employees are enrolled in evening-school courses at public, semipublic, and private commercial and technical schools. Numerous others are broadening their qualifications and fields of interest by working toward bachelor's degrees, master's degrees, and doctor's degrees at colleges and universities both in Washington and in the field. A recent analysis of the enrollment at a school of public affairs in Washington, for example, showed that one-sixth were from the Department of Agriculture.

An increasing number of the Department's personnel are receiving higher degrees; at present 47 percent of all men and 16 percent of all women in the Department in Washington have at least a bachelor's degree in some field. About 8 percent of the men have doctor's degrees.

Recently educational advisors have been designated in every bureau and office. They form a council which works under the leadership of this Office. The counsellors provide information and guidance to employees interested in postentry education. With the assistance of these advisors, close relations are maintained with educational institutions for the purpose of making evening school, correspondence courses, and short courses available to employees. Employees generally are well informed of pending civil-service examinations and are constantly studying to qualify for better positions.

A number of informal-discussion groups have been organized by employees in various units. These groups meet after working hours and discuss objectives, procedures, relationships, or whatever phase of work with which they wish to become more familiar. These discussions provide valuable personal contacts and give employees a more complete knowledge of the work in their own units as well as a greater appreciation of its relationship to adjacent units and to the total program of the Department.

ORIENTATION OF NEW EMPLOYEES

A definite program for orienting new employees is currently being developed by the Office. New employees face the necessity of adjusting themselves to new working requirements and often to a strange environment. Their subsequent performance in the Department is vitally affected by the start they make. In order to aid in making these first adjustments, personnel officials have experimented with various methods of procedure. New employees have been called together periodically to participate in programs which are designed to lead the individual to a realization of the importance of his work contribution to the whole and to acquaint him with the geography, history, and objectives of the Department, the organizations by which its work is carried on, and the rules and regulations governing official conduct.

SALARY ADMINISTRATION

Management recognizes the necessity of providing material rewards to employees for increased efficiency in the performance of their work. The policy which governs the distribution of these rewards must be founded upon sound principles of personnel administration; it must be definite and dependable; and it must be clearly expressed in terms understandable to administrative officials and employees alike.

Administrative promotions have been discussed in the Department for years, but these discussions have not led to the formulation of written or expressed general policies. The Office made a comprehensive survey of past salary administration in all bureaus and offices, particularly with regard to the age of salaries, and it was ascertained that, generally speaking, there has been no widespread abuse of the discretionary power to grant administrative promotions. Among the various organizational units, however, there is considerable variation in the age of salaries due in part to differences in the availability of funds, and in part to differences in administrative policy as between bureaus.

There are employees in several bureaus who have been receiving high efficiency ratings but have not enjoyed a salary increase for a considerable length of time. A small administrative promotion may contribute but little to an employee's monetary income, but the knowledge that efficiency is recognized by fellow workers and superiors is extremely gratifying and stimulating. It seems obvious that an employee who by reason of his efficiency rating and relationship with his superior is eligible for but who does not get a salary increase over a long period, becomes a discouraged employee whose level of performance tends gradually to decline. Such an employee reaches the point where he is not deserving of a salary increase, whereas if he had received the proper recognition for his services, it would have tended to keep his performance at a high level of efficiency.

With the view toward the elimination of inequalities and the establishment of a consistent and uniform guide for the entire Department, a definite policy governing administrative promotions was being prepared for the Secretary at the close of the year.

CLASSIFICATION OF POSITIONS

The investigation, analysis, and allocation of Washington and field positions subject to the Classification Act of 1923, as amended, and Executive Order No. 6746 continues as a basic function of the Office of Personnel. Not only does position classification operate to determine the proper grades and classes and the salaries of positions on a uniform basis across bureau lines, but it serves as an indispensable tool in such personnel processes as recruiting, transfer, and promotion.

The principal objective of position classification is to afford equal pay for equal work, an objective difficult of attainment in a department having hundreds of classes of positions in many bureaus and located in more than 3,000 field stations as well as in Washington.

Some 8,829 classification actions covering positions in Washington [1] and 34,735 for positions in the field were acted upon this year by the classification staff. These represented not only single positions in

[1] There were 6,799 in 1938.

many organizational units but also all positions in some very large units. Two major bureaus reviewed all positions and submitted new job descriptions in those cases where existing ones did not fully or accurately describe the duties and responsibilities of positions.

Bureaus have been encouraged to provide more complete facts and to present the organizational background, with their recommendations, in order that cases may be decided expeditiously and a smooth flow of work effected. Their cooperation has been most gratifying.

An increasing number of surveys were made of certain field positions and field stations with a view to bringing all jobs into correct relationship with each other. These activities, coupled with frequent conferences with field officials temporarily in Washington and field trips taken by most of our staff members during the year, have resulted in a clearer understanding of field problems and, on the part of field officials, a better understanding of the problems faced by the Office in carrying out this work. Major field surveys covered all types of positions of the shelterbelt project at Lincoln, Nebr.; the Northeastern Timber Salvage Administration at Boston and Worcester, Mass., and Manchester, N. H.; the Soil Conservation Service at Spartanburg, S. C., and Amarillo, Tex.; and the Federal Crop Insurance Corporation at Minneapolis, Minn.

It was not possible to give much time to the preparation of class specifications; however, some were drawn up in collaboration with Bureau officials, and it is anticipated that this activity will be expanded in the coming year.

One bureau prepared an initial draft of specifications covering all positions in its rather extensive field service. The draft was submitted to this Office for review and criticism. It was carefully checked, suggestions as to improvements were made, and the grade structure was analyzed for compliance with uniform Department standards. When completed these class specifications will afford an excellent and consistent guide to the allocation of positions in this Bureau.

Several bureaus detailed field-personnel men for a period of from 1 to 3 months to study classification methods and procedures in this Office. These details have proven to be of value both to the Bureau and to the Office.

ORGANIZATION PLANNING

Administration is constantly faced with problems of distributing functions, unit relationships, lines of authority, flow of work, effectiveness of management, advisability of mergers and reorganizations, and coordination of efforts. The Office directed increased attention to studying, analyzing, recommending, and supplying services along these lines.

Numerous minor organization changes proposed by the bureaus and offices were reviewed and acted upon. Assistance was given in the reorganization of the Bureau of Agricultural Economics and the Sugar Division, in the internal reorganization of the Office of Marketing and Regulatory Work, and in the establishment of the Office of Foreign Agricultural Relations and the Office of C. C. C. Activities. A budgetary study was conducted to determine probable personnel changes, in order that classification and placement work might be better planned. Functional statements were prepared for all bureaus

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and offices and most of their divisions. A functional survey was made of the personnel units throughout the Department. Other work included studies of suspected functional overlapping, with recommendations for changes where necessary, the gathering and compiling of basic organization data for future use, and the planning and preparation of material for numerous charts.

The long-range objectives of this type of work are: To investigate, analyze, and make recommendations on the disposition of proposed organizational changes requiring the approval of the Director of Personnel as provided in the Department Regulations; to conduct basic studies in organization, procedure, and management for the purpose of determining functions, authorities, lines of supervision, flow of work, and other basic organization materials; to determine the conformity of Department subdivisions to recognized principles of organization and management; to develop an advisory organizational service available to the bureaus; to make procedural studies, prepare work-flow charts, analyze results, and make recommendations for procedural improvements; to draft and keep current functional statements of bureaus and offices and their divisions; to establish uniform organizational terminology, prevent functional overlapping, perfect fundamental work processes, and coordinate functions. The work of the year has facilitated better management and improved operating machinery in many agencies of the Department.

PERSONNEL CHANGES

There were 108,748 personnel actions handled and recorded during the year. These actions included all appointments, terminations, promotions, transfers, extensions, reinstatements, reductions, suspensions, and numerous minor personnel changes and combinations of changes. The work involved in their disposition varied from simple routine handling and recording in some cases to very thorough review and inquiry in a large number of others.

On June 30, there were 81,970 employees serving under formal appointment by the Secretary of Agriculture, as compared with 70,181 on June 30, 1938 (table 1). (The 1938 report showed 68,431 employees excluding 1,750 collaborators without compensation.)

TABLE 1.—*Appointments to and separations from the Department of Agriculture, 1934–39*

Year ended June 30	Employees on rolls of Department			Employees appointed	Separated from Department
	Department	Field	Total		
1934	10,032	28,591	38,623	31,434	19,355
1935	11,437	32,643	44,080	29,092	23,635
1936	11,382	42,140	53,522	30,634	21,192
1937	13,371	46,858	60,229	34,561	27,854
1938	11,185	57,246	68,431	41,677	33,475
1939	11,936	[1] 70,034	[1] 81,970	30,311	18,522

[1] Includes collaborators without compensation.

The increase in personnel is accounted for by expansion in almost all bureaus of the Department. The greatest increases were in the Farm Security Administration and the Soil Conservation Service

with additions of approximately 4,500 and 2,500 employees respectively. The Northeastern Timber Salvage Administration, organized during the year, added almost 1,200 employees, most of them temporary, to the rolls of the Department. The number of field stations increased from 2,648 in 1938 to 3,151 in 1939.

The Bureau of Animal Industry alone showed a sizeable decrease, with 900 fewer employees at the close of the year. Six other bureaus reported decreases ranging from 1 to 61.

On June 30, there were 10,921 employees serving without compensation from the Department of Agriculture as follows: Agents, 8,092; collaborators, 2,091; deputy game wardens, 738; total, 10,921.

The number of employee advancements from grade to grade (excluding temporary employees) and salary promotions within the grade was 21,533, as compared with 17,639 in 1938, 11,960 in 1937, and 10,815 in 1936.

The 30,311 secretarial appointments (table 1) include appointments of agents and collaborators without compensation, seasonal workers, and per diem, temporary, excepted and emergency, as well as regular civil-service employees. In addition, 10,097 vacancies in regular permanent positions were filled by promotions within the various bureaus, 3,475 by interbureau transfer, and 394 by transfer from other departments and agencies.

Prior authority was obtained from the Civil Service Commission for 4,990 temporary appointments, 1,144 extensions of temporary appointments, and 330 reinstatements and for all changes in status. Recommendations received from bureaus and offices for personnel changes falling within one of the above categories and involving employees subject to civil-service rules and regulations were reviewed for the purpose of ascertaining the legal basis for recommended actions and certifying that such personnel changes were properly authorized.

SELECTION AND PLACEMENT

PROMOTION FROM WITHIN

Placement machinery was established for implementing the promotion-from-within policy of the Department. An adequate picture of the qualifications of every employee was necessary for this program, and therefore each employee was requested to complete a personnel questionnaire outlining his education, experience, interests, etc. A detailed code was developed in order to record this information on punch cards for use with mechanical tabulating equipment. Over 62,000 coded qualification cards were prepared on the basis of these questionnaires for the permanent personnel of the Department. Each new employee who receives a permanent or probational appointment is required to submit a questionnaire to the Office at the close of the fifth month of his service in the Department.

From the qualification cards, lists, or panels were prepared on the basis of fields of experience or educational background. During the year approximately 100 panels were prepared. These panels show primarily the types of experience an employee has had—the occupational field and the level and duration of such experience. In addition there is information on his educational background, the extent of his education, and his subject of specialization. Other necessary

data appear, such as the employee's sex and race, his legal residence, whether or not he has civil-service status, his present designation, grade, and salary, and the bureau and headquarters where he is employed.

While the panels have been largely experimental in nature, they have been used in the effort to locate candidates for over 200 positions. Meetings and conferences have been held collectively and individually with bureau personnel officers to explain to them the uses of these panels and the purposes they will serve. The Office is now supplying duplicate copies of the panels to the bureau personnel officers for employees in their respective agencies, and in some cases these panels will be used in the field offices. The panels are designed to assist the bureau personnel officer in determining whether he has persons available in his agency who are qualified to fill a vacancy before he submits to the Office a request for certification of eligibles.

In this connection the Department form for Request for Eligibles has been revised. The bureau is now required to certify that all eligible employees within it who were suitable or available for the vacancy to be filled have been considered. The form was further revised to provide for a description of the duties of the position and a statement of qualifications required of candidates to adequately fill it.

During the year 90 announcements of existing vacancies in the Department in Washington, D. C., or in the field were published on bulletin boards. These announcements covered 126 positions. The applications received from these postings and the eligibles found through searching the panels were referred to the various bureaus and offices. One hundred and seventy-seven positions were filled in this way. In addition, 163 positions were filled by candidates for transfer from other departments or by reinstatement.

The efforts of the Office in this direction have provided a stimulus to the bureaus and offices to fill vacancies by promotion and reassignment from within their respective organizations, with the result that an increased number of vacancies are now being filled in that way.

The Office received 2,775 formal applications for employment, which were reviewed and classified according to occupations. Insofar as possible, applicants for positions which are most frequently filled were made the subjects of personnel inquiries prior to referral to bureaus.

Three thousand four hundred and forty-two candidates for employment, transfer, or promotion were interviewed.

PERSONNEL INQUIRIES

An intensive educational campaign has been conducted to impress on employing officers the desirability of properly verifying the experience and background of prospective employees. This has been done through collective and individual conferences with bureau personnel officers and other officials and by the preparation and distribution of suggested methods of procedure.

The responsibility for making personnel inquiries was placed on the bureaus and offices. Personnel inquiries made by the Office have been limited to those cases where referrals were made by the Office to fill positions in the bureaus and offices, when the inquiries were not made about persons selected for appointment by the bureaus themselves, and when specific requests were received that such inquiries be

conducted. Before any employee of the Department is referred by the Office for transfer, his service record in the Department is carefully checked. Eight hundred and twenty-nine personnel inquiries were conducted by the Office. This work involved correspondence with former employers, educational institutions, examination of service records in the Government departments and agencies, and personal interviews with former employers and supervisors. These inquiries are made not only in regard to character and conduct but to verify the qualifications (education, training, and experience) of the candidates for the job to be filled.

REVIEW OF QUALIFICATIONS

Recommendations for appointment or change in status are reviewed not only for procedural accuracy and conformity to laws and regulations but also for adequacy of qualifications for the job in question. The Department forms for Recommendation to the Secretary, and Report of Employment to the Secretary under the Act of June 26, 1930, were revised to permit the furnishing of more detailed and adequate information concerning present or prospective employees so that appointment procedure could be standardized and complete information furnished to permit prompt and intelligent action on the part of officials in the Office of Personnel who handled the recommendations. The revision of these forms and the supplying of the information called for, made possible more adequate service records in the Department.

Instructions for filling out the new forms were prepared and submitted to the bureaus and offices. The Office reviewed 40,383 recommendations in regard to qualifications. In certain special cases recommendations were reviewed intensively and were taken up with the bureaus. Some recommendations were reviewed more carefully than others in order to establish better standards of selection.

DEPARTMENTAL EXAMINATIONS

The Office conducted a series of 3 departmental stenographic examinations which were open to all junior stenographers in the Department at Washington who had civil-service status. The purpose of these examinations was to establish lists of stenographers qualified for promotion from grade CAF–2 to certain positions in grade CAF–3. The examinations assisted the Office in bringing opportunities for advancement to the attention of the most successful candidates. They also served as experiments in connection with the Department's promotion procedures. Although the examinations were not compulsory in any way, 560 employees were examined.

In addition to these examinations, the Office collaborated with the Civil Service Commission in the preparation of a 140-word-per-minute stenographic examination, which was given to persons in the classified service who had taken the course in shorthand reporting given by the Graduate School of the Department. Thirty-six persons were examined.

CERTIFICATION OF ELIGIBLES FROM CIVIL SERVICE REGISTERS

During the year 2,369 certificates of eligibles were obtained from the Civil Service Commission, from which bureaus and offices made

appointments to positions ranging from assistant messenger, CU–2, $1,080 per annum, to highly specialized, responsible, and technical positions in the $5,600 per annum salary class. Of the above total, 2,051 certificates were obtained for the purpose of making probational appointments, and 318 were for temporary appointments.

The work incident to receiving and reporting these certificates involved the maintenance of control records of the disposition made of each eligible whose name was listed on the certificate, processing appointment papers, including recommendations, proofs of date of birth, medical certificates, fingerprint charts, and declarations of appointee, and certifying that such matters as proof of graduation from college, reasons for passing over veteran eligibles, applications, and examination records were in order.

Securing eligibles for the bureaus and offices of the Department from the Civil Service Commission's registers involved numerous contacts with the bureaus and offices and with representatives of the Commission. Not only were eligibles formally requested and their certificates and examination records transmitted, but inquiries and suggestions were made relative to the qualifications that eligibles should possess for successful performance in specific positions.

Consolidating the responsibility for securing certificates of qualified eligibles from registers and the responsibility for intensive participation in the preparation and giving of appropriate civil-service examinations enhanced the effectiveness of both of these functions.

CIVIL-SERVICE EXAMINATIONS

The Civil Service Commission was requested to announce and hold a total of 91 open-competitive examinations for the purpose of establishing registers of qualified eligibles from which selections could be made for filling vacancies in the Department. In addition, open-competitive examinations were given by the district managers of the Commission to provide lists of eligibles for vacancies in field-service positions which come under their jurisdiction.

Improvements were noted in the manner in which the examination needs of the Department were provided for as a result of intensive effort on the part of staff members of the Office, to coordinate the necessary examinations, to cooperate with the Civil Service Commission in improving the quality of candidates that could pass examinations, and to have made available lists of eligibles at a time when the largest possible number of outstanding candidates would be available and when the services of persons who had qualified through civil-service examination were needed.

One noteworthy example of coordination of examinations is the preparation and consummation of an examination announced by the Civil Service Commission on January 23, 1939, for the positions of assistant biologist (wildlife), $2,600 a year; associate biologist (wildlife), $3,200 a year; and biologist (wildlife), $3,800 a year. Education, experience, and other requirements to be incorporated into the announcement of this examination were developed in consultation with all bureaus and services of the Department that employ biologists in the professional and scientific service above the P–1 grade, and in all negotiations with the Civil Service Commission concern-

ing the examination, there was represented the opinion of the bureaus and services, and the Office of Personnel. The resulting registers of eligibles satisfy the needs not only of one particular bureau or service, but of the entire Department.

A survey of personnel needs in the entrance grade in the professional and scientific service was completed in November 1938, and requests for 35 examinations were based upon the findings. These 35 examinations were later consolidated into 20, and with 2 added by the Civil Service Commission, they were given simultaneously under the title of junior professional assistant. They were designed to cover practically all the major fields of activity in which the Department is engaged. The objective was to recruit through the Commission, college graduates of a high caliber the year they received their bachelor's degrees.

Of the 91 examinations requested, recommendations were made that 47 be of the assembled or written type; the remaining 44 were to be unassembled. On June 30, 1939, requests for announcements of 35 examinations for the Department were pending at the Civil Service Commission.

HANDLING OF PERSONNEL ACTIONS

For many years bureau recommendations for personnel actions, upon receipt in the Office, have been copied onto large journal sheets. These sheets when signed by the Secretary constituted the legal basis for appointments, transfers, terminations, promotions, etc. A notification form for each personnel action was then prepared, which was sent to the bureau or bureaus concerned. The preparation of the notification form and journal sheets for all the bureaus and offices placed such a heavy clerical and stenographic load upon the Office that during period of expansion considerable delay was caused by the great amount of clerical work involved. To expedite the handling of these personnel actions, a standard combination form was devised and put into effect on July 1 by all the bureaus and offices of the Department.

The new form replaces both the journal and the notification form and is prepared in the bureau or office requesting personnel action. This system has effected an over-all reduction in the number of steps in the processing of a personnel action, and as the forms are printed in a combination arrangement, sufficient copies can be prepared in one typing operation to provide all notices and file copies. The new procedure will result in a substantial saving in the amount of clerical work necessitated in the handling of personnel actions.

RECORDING AND STATISTICAL WORK

The Office maintains complete personal-history files for present and former employees, as well as brief service-record cards, maintained for quick reference, which give an up-to-date summary of each employee's service in the Department.

The coding and punching on tabulation cards of qualification records of employees from questionnaires previously distributed, was begun in July 1938 and completed in October. The records of some 62,000 employees were received, coded, and punched.

The use of machine-tabulating equipment has made it possible to prepare reports more quickly and has greatly broadened the utilization of essential information in the personnel program.

The following is a summary of the work with machine-tabulating equipment:

	Number
Statistical cards punched (includes both original cards and personnel changes)	130,006
Qualification cards punched (includes both original cards and personnel changes)	97,000
Total	227,006
Qualification panels:	
Bureau	6
Occupational	58
Total	64
Recurring reports:	
Weekly	1
Monthly	7
Quarterly	2
Annually	5
Special reports	118

REVISION OF CIVIL-SERVICE RULES AND REGULATIONS

The civil-service rules and regulations were amended by Executive Order No. 7915, June 24, 1938, effective February 1, 1939. Employment in the Department of Agriculture was primarily affected by changes in schedule A. Authority was withdrawn for employment of large numbers of temporary seasonal workers in the Forest Service and the Bureau of Entomology and Plant Quarantine. A number of other changes affecting small groups of positions were made.

The new civil-service rules provided for the filling of positions through competitive promotion processes, and vested in the Civil Service Commission the authority to direct the holding of competitive examinations for promotion and transfer. Section 5 of Executive Order 7916, June 24, 1938, provided that the Civil Service Commission, subject to the Civil Service Act, the rules thereunder, and the Classification Act of 1923, as amended, initiate, supervise, and enforce a system as uniform as practicable, for the recruitment, examination, certification, promotion from grade to grade, transfer, and reinstatement of employees in the classified civil service, which system should, so far as practicable, be competitive, with due regard to prior experience and service.

Members of the staff of the Office have had many conferences with officials of this Department and other governmental agencies and have drafted and submitted tentative drafts of regulations on competitive-promotion procedure. Participation in this new phase of personnel work in the Federal Government has been very active.

EXTENSION OF THE COMPETITIVE CLASSIFIED SERVICE

Executive Order No. 7916, June 24, 1938, effective February 1, 1939, provided for inclusion in the competitive classified civil service of positions theretofore exempt. It was decided that all positions in the

Department of Agriculture under title II of the Public Works Administration Appropriation Act of 1939 were subject to inclusion in the competitive classified civil service. There were approximately 1,200 positions in the Department subject to this order. Procedure for effecting the classification of these employees under the Civil Service Act was worked out in conjunction with the Civil Service Commission. Establishment of service records and verification of each employee's eligibility for classification were necessary. The procedure involved the submission of master lists of employees to the Civil Service Commission, subsequently to be followed by individual recommendations properly certified and accompanied by statements of education and qualifications on prescribed forms; medical certificate, fingerprint chart, and affidavit as to members of family in service. The Executive order provided that the incumbents recommended for classification should pass suitable noncompetitive examinations. These classifications are now in process.

HEALTH

All health and medical activities of the Department were placed under the general direction of this Office by order of the Secretary July 1, 1938.

Emergency rooms are maintained for the purpose of furnishing first-aid assistance to employees requiring emergency medical attention during the course of their work. This service is available to all employees in Washington. The central emergency room and eight branch rooms are located in the most important buildings occupied by the Department employees in the city.

The work of the various emergency rooms was coordinated under the direction of a supervising nurse, uniform regulations were applied to each unit, and standard records and equipment were installed. As numerous first-aid kits have been distributed, all groups of employees now have access either to an emergency room or to a first-aid kit.

The emergency rooms reported cases as follows:

	Number
Total	44,519
Referred to United States Public Health Service	239
Referred home	349
Contagion suspected	18
Referred to hospital	17
Calls to various offices	57
Persons using beds	6,236
W. P. A. cases	3,088

An analysis was made of the records in the central emergency room in order to determine the nature of the cases handled, the time spent in servicing these, and the type of treatment required. In a sample of 4,020 cases, 2,763 were female and 1,257 male. From 1 to 5 minutes of attention was given to each of 3,020 cases; 310 required from 6 to 30 minutes a piece; and 678 needed 31 minutes or more of care each. The cases involving the longer periods of care were those that required rest. Most numerous were cases needing eye, ear, nose, or throat treatments. Next in frequency were cases of cuts, wounds, sprains, or minor ailments. Third in order were stomach, nausea, and nervous cases. Of the 817 cases requiring rest, 96 percent were

women and 4 percent men. Two hundred and thirteen of those who came for rest had headaches, 501 had "personal reasons," and 103 rested during the lunch hour.

Twenty-two of the 4,020 cases were sent home because of temperature, cold, nausea, or serious injury.

Of those sent home, 16 were women and 6 men. Twenty-one cases, 15 men and 6 women, were referred to the Public Health Service.

The health program of the Office of Personnel is still in the process of development.

SAFETY

Considerable progress was made in the development of an effective safety program, Department-wide in scope. Four large bureaus and offices have operating programs. New bulletins and literature analyzing the cause of accidents, recommended preventative measures, hazards and their removal or reduction, and related subjects were distributed. Field inspections were made covering many areas and many types of projects, and accident and health hazards were reported and remedial measures suggested.

A review of departmental publications resulted in the withdrawal from distribution of one recommending the use of a dangerous chemical.

Clarification of procurement restrictions on the purchase of certain safety materials has been obtained. As a result of efforts carried on for 2 years to secure the general adoption of more effective first-aid treatment for burns, the necessary materials have now been placed on the General Schedule of Supplies.

The First Annual Report of Departmental Accident Record was compiled and issued.

There was a 34-percent reduction in the total of accidental deaths, and the frequency of nonfatal accidents was reduced 19 percent.

The comparison of the number and frequency of fatal injuries reported by the various bureaus during the first 6 months of 1938 with the number during the corresponding period of 1939 is shown in table 2. Table 3 shows the comparison of the frequency of nonfatal accidents for the same periods. A comparison for the year is not possible as we do not have detailed reports of the 84 deaths which occurred during the last 6 months of 1937.

TABLE 2.—*Fatal injuries reported and frequency of fatal injuries per million man-hours, January–June 1938–39*

Month	Work equivalent in—		Fatal injuries reported		Increase or decrease	Frequency per million man-hours		Increase or decrease in frequency
	1938	1939	1938	1939		1938	1939	
	Man-hours	*Man-hours*	*Number*	*Number*	*Percent*			*Percent*
January	29,030,880	32,476,588	10	5	−50	0.344	0.154	−55
February	26,692,447	29,724,507	2	7	+250	.075	.235	+213
March	32,991,710	35,374,718	10	2	−80	.303	.056	−82
April	31,329,858	31,109,887	9	3	−67	.287	.096	−66
May	33,246,300	38,758,348	7	4	−43	.210	.103	−51
June	30,226,435	36,854,457	11	6	−45	.364	.163	−55
Total	183,517,630	204,298,505	49	27	−45	.267	.132	−50

TABLE 3.—*Nonfatal injuries reported and frequency of nonfatal injuries per million man-hours, January–June 1938–39*

Month	Work equivalent in—		Nonfatal injuries reported		Increase or decrease	Frequency per million man-hours		Decrease in frequency
	1938	1939	1938	1939		1938	1939	
	Man-hours	*Man-hours*	*Number*	*Number*	*Percent*			*Percent*
January	29,030,880	32,476,588	761	552	−27	26.21	17.00	35
February	26,692,447	29,724,507	589	503	−15	22.07	16.92	23
March	32,991,710	35,374.718	624	538	−14	18.91	15.21	20
April	31,329,858	31,109,887	478	424	−11	15.26	13.63	11
May	33,246,300	38,758,348	547	609	+11	16.45	15.71	4
June	30,226,435	36,854,457	558	678	+22	18.46	18.40	0.3
Total	183,517,630	204,298,505	3,557	3,304	−7	19.38	16.17	16

Tables 2 and 3 show that while the average frequency of nonfatal injuries for the first 6 months of 1939 is 16 percent under that for the same period of 1938, the 1939 summer peak started earlier than in 1938. The frequency of fatal injuries was held to a new low during the first 6 months of 1939. While the summer months produce the greatest number of accidents and while reports for July indicate that the number of fatal injuries for that month will be greater than that reported during July 1938, the average for the last 6 months of 1939 will be lower than the average in 1938.

Figured on the basis of average costs of fatal and nonfatal injuries as determined for the Department by the United States Employees Compensation Commission, the reduction in injuries last year, principally due to the effectiveness of bureau safety programs, amounts to a monetary saving of $340,978 in compensation and medical expenses alone. According to the published data of large compensation-insurance firms the total cost of an accidental injury averages four times the cost of compensation and medical expense. On that basis the total saving approximates $1,363,912.

The saving is also reflected in the following comparison of the total sums paid by the United States Employees Compensation Commission on account of claims filed by the various bureaus and offices of the Department of Agriculture during the last 3 years: 1936, $725,010; 1937, $649,661; 1938, $438,545 (estimated).

The total claims for 1937 were approximately 10 percent less than for 1936, and the figures for 1938 are 40 percent less than for 1936. The last figures do not include the costs of all Works Progress Administration cases reported by some bureaus and none of the Civilian Conservation Corps cases.

New phases of our safety program will be developed as rapidly as circumstances permit. The objective is to cover every operation in the Department, no matter how small, and wherever possible to eliminate all accident, health, and fire hazards.

WELFARE ACTIVITIES

The year 1939 marked the establishment of a special unit in the Office for giving official encouragement and aid to activities which contribute to broad personal development of employees. The growth of this program reflects a firm and renewed conviction that the improvement of employee health, mental direction, attitudes, and general

morale will pay dividends in better public service. The objectives of an expanded program of employee activities received the approval of officials and employee groups in over 30 conferences held during its development stages.

The functions of the welfare unit consist of maintaining general oversight over employee activities, assisting in planning new activities, and rendering aid to organizations in developing proper fiscal-control procedure.

A committee of employees representing existing employee activities has been requested to recommend a broad program of leisure-time activities and appropriate types of employee organizations designed in some particular to interest employees of all ages and types and to provide a stimulus to health, mind, and morale, which will be of mutual benefit to employees and to the public service.

Organized employee leisure-time activities during the year consisted of golf, horseback riding, men's bowling, women's bowling, men's tennis, women's tennis, men's basketball, women's basketball, men's softball, women's softball, archery, hiking, duplicate bridge, camera club, spelling club, swimming, chess, stamp collecting, dramatics, orchestra and symphonic choir, chorus, arts and crafts, and various social gatherings.

Many honors were won in interdepartmental athletic events. Interbureau events in softball and bowling had substantial employee participation. A photographic competition and exhibit were held. The orchestra and symphonic choir and the chorus all presented their usual commendable public performances. The dramatic group, after a period of inactivity, changed its name to "Agriculture Players" and got off to a fresh start.

The Credit Union and the Beneficial and Relief Association continued to serve the employees. On June 30 the Credit Union had 2,040 members, who had on deposit a total of $88,285. A total of $78,659 was on loan to 1,257 members. The Beneficial and Relief Association on June 15 had 13,515 members, who were insured for $19,051,056.

USDA CLUBS

Some years ago United States Department of Agriculture Clubs, usually known as "USDA Clubs," were organized in many cities. While these clubs were organized primarily to provide a means for Department representatives in the various localities to become acquainted with each other personally and thereby promote interbureau cooperation and coordination in the field, they also provided a means whereby visiting officials from Washington could acquaint supervisory employees with activities in Washington which were of interest and value to them in their official capacities. The clubs have operated successfully and have clearly demonstrated their value.

It is now proposed to broaden their scope of activities, to revitalize existing clubs where necessary, and to organize new ones in suitable locations. It is hoped that they will provide a needed medium for (1) promoting employee welfare; (2) stimulating training and education of employees; (3) developing personal acquaintance among employees of the several bureaus in each area; (4) familiarizing field workers with the work of the Department as a whole; and (5) providing a channel through which the many activities of the Depart-

ment may be informally correlated in behalf of the best possible service to the public and through which the services of the Department may be interpreted to the public.

Committees of employees representing the principal agencies in each of nearly 100 cities have been requested to explore the steps necessary to reach these objectives in each city. Out of their deliberations should come the form of organization and the nature of activities most likely to accomplish the purposes outlined.

LEAVE

From a study of sick- and annual-leave records of Washington employees in five representative bureaus it was ascertained that these employees used an average of 22.2 days annual leave in 1938 as compared with the Department averages of 20.6 days in 1937 and 19.9 days in 1936. The average accumulation was 17.4 days. More than 4 percent have accumulated the maximum of 60 days and have forfeited the excess accumulation. More than 14 percent were never absent for more than 3 days at any one time during the year. The average longest period of leave for all employees was 11 days.

The average sick leave used by these employees was 6 days, as compared with Department averages of 6.6 days in 1937 and 7.5 days in 1936. The average accumulated sick leave was 26 days. Twenty-five percent took no sick leave during the year, and 6.5 percent have taken none in the last 3 years.

The leave records were further analyzed in relation to age, marital status, and salary for men and women. Table 4 indicates that differences between men and women in the use of leave privileges are not as pronounced when differences in salary levels are taken into consideration:

TABLE 4.—*Average number of days sick and annual leave used by men and women in 5 bureaus, classified in salary groups*

Salary group	Annual leave		Sick leave	
	Women	Men	Women	Men
	Days	*Days*	*Days*	*Days*
Under $1,800	24.0	21.9	8.5	6.9
$1,800 to $2,300	23.1	23.9	7.7	6.0
$2,300 to $3,200	23.4	22.0	6.1	3.1
$3,200 to $5,600	23.3	20.7	6.1	3.2
$5,600 and over		12.9		2.3
All	23.6	21.0	8.0	4.3

The Office dispensed with the maintenance of consolidated leave records. Each bureau records and supervises the granting of leave to its own employees according to the uniform leave regulations.

EFFICIENCY RATINGS

Intensified efforts were made to provide a more equitable, accurate, and dependable measure of the relative service value of employees through more effective use of the efficiency-rating system.

The rating system is administered by each bureau and office in accordance with procedures outlined by the Civil Service Commis-

sion. This has naturally resulted in the growth of certain varying principles and divergent standards of rating. The Office has undertaken to attain a more uniform approach to rating problems by providing a central source of information about rating and by sponsoring discussion meetings of bureau officials charged with rating responsibilities. Bureaus have been encouraged to develop programs of supervisor training to insure more accurate and equitable rating; several have made noteworthy progress in this direction.

A factual summary of 1938 ratings was prepared and circulated among rating officials, and at the request of several bureaus a manual of suggestions and instructions for the preparation of ratings was developed. This was placed in the hands of supervisors throughout the Department.

Effective use of the rating system is vital to good supervision. An effort was made to tie the rating system in more closely with other phases of personnel management. The promotion-from-within policy of the Department and the increasing number of transfers make it imperative that the efficiency rating be a reliable measure of past performance. Ratings must be equitable and dependable as among all bureaus. Only when this is accomplished can they be accepted as a sound guide to the administration of salary increases, demotions, transfers, reassignments, and other actions. Supervisors have been encouraged insofar as possible to make work adjustments according to special strengths and weaknesses in performance as shown in the periodic rating.

The appeals procedure was amended to provide for direct appeal to the bureau Board of Review of Efficiency Ratings prior to action through the regular channels established for other grievances. A time limit was placed on appeals to facilitate prompt action on all cases.

The employee notification form was revised in order to convey certain desirable information to all employees. The new form gives not only the rating and its significance, but encourages supervisor-employee discussion of the rating and informs him of his privilege to appeal as well. It is anticipated that this form will result in a more conscientious approach to the rating process on the part of supervisors and will invite greater employee confidence in the ratings themselves.

RETIREMENT

There were 42,229 employees of the Department subject to the provisions of the Retirement Act during the year. Retirement records show the following cases handled:

Nature of case:	*Cases*
Master retirement record cards to Civil Service Commission	3,622
Applications for refund	1,228
Applications for service credit	315
Civil Service Commission form No. 3168	179
Requests for letter-of-authority service	5,661
Requests for previous Government service	4,277
Master retirement record cards to bureau (permanent)	7,800
Charge cards	7,800
Correspondence	1,402
Dual compensation cases	432
Requests returned to Civil Service Commission (no record)	600
Maintenance of appointment register	305
Transfers within the Department	514

Nature of case—Continued	*Cases*
Forms 3037 and property-claim cases	50
Maintenance of separation register	1,899

It required 39,404 paper transactions to complete the above cases.

There were 198 retirements from the service, 58 of which were for disability (table 5). Thirty-one of the annuity retirements were optional, 100 were retirements for age, 6 were due to reduction in force, and 3 were defacto retirements.

TABLE 5.—*Number of employees retired, 1936–39*

Year ended June 30	Annuity retirements, by service				Disability retirements, by service				Cases disposed of
	P	SP	CAF	Cu	P	SP	CAF	Cu	
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
1936	29	50	18	6	11	19	18	3	154
1937	35	42	18	5	8	20	20	5	153
1938	38	48	18	12	11	15	27	1	170
1939	44	60	29	7	12	11	28	7	198

The smallest annuity granted was $196.92. The largest straight-life annuity was $1,330.56, and the largest increased annuity with forfeiture was $1,351.68. Table 6 shows the average annuities in the four services for a 4-year period.

TABLE 6.—*Average annuities in the 4 services, 1936–39*

Year ended June 30	Average annuities by service			
	P	SP	CAF	CU
1936	$1,068.59	$990.43	$865.08	$654.05
1937	1,049.04	1,027.02	887.82	708.79
1938	1,150.35	1,068.48	901.68	902.35
1939	1,112.75	1,061.72	871.63	631.74

There were no extensions or continuances granted during the year.

Under date of June 24, 1938, the President issued Executive Order No. 7916, effective February 1, 1939, which brought within the purview of the Retirement Act employees who were paid from P. W. A. funds and who had been employed continuously for 6 months prior to the effective date of the order. Again on April 10, 1939, the provisions of the Retirement Act were extended by Executive Order No. 8083, effective May 1, 1939, to include those employees who had been appointed to excepted positions from an open competitive register of the Civil Service Commission. These two orders materially increased the volume of work of the Retirement Section.

INVESTIGATIONS

The Division of Investigations conducted 149 investigations. These investigations and 1,022 disciplinary and personnel cases submitted by the various bureaus and offices for review and consideration resulted in 1,138 actions as follows:

Suspension without pay pending investigation	74
Preferment of formal charges	66

Removal as a result of formal charges		37
Reprimand by chief of bureau		121
Reprimand by Secretary		42
Reduction in grade and/or salary		2
Reduction in grade and/or salary and reprimand by Secretary		3
Reduction in grade and/or salary and transfer		2
Leave without pay for disciplinary reasons		12
Suspension without pay and reprimand by Secretary		86
Suspension without pay, reprimand by Secretary, and reduction in grade and/or salary		3
Suspension without pay, reprimand by Secretary, and transfer		1
Reduction in grade and/or salary, transfer, and reprimand by Secretary		1
Reprimand by Secretary and transfer		2
Transfer		1
Revocation of promotion		2
Appointment terminated (46 with prejudice and 21 without prejudice)		67
Resignation accepted (53 with prejudice and 15 without prejudice)		68
Action taken for other than disciplinary reasons		548
Appointment terminated without prejudice	325	
Resignation accepted without prejudice	128	
Other	95	
Total		1,138

Other work in connection with investigations included 909 interviews with employees and officials of this Department and outside agencies and review of numerous letters prepared in the bureaus for the Secretary's signature.

EMPLOYEE UNIONS

It is an expressed policy of the Department that—

> every employee has the right to join or refrain from joining any organization or association of employees, and no employee shall be required to join or refrain from joining as a condition of employment, transfer, promotion, or retention in service.

Three national organizations—the National Federation of Federal Employees, the American Federation of Government Employees, and the United Federal Workers of America—are represented in the Department. Representatives from each union make up an Inter-Union Council, which coordinates the efforts of all organized employees to improve the working environment. The Office has had frequent contacts with representatives of the unions and the Inter-Union Council. Their recommendations and views on many basic policies have been solicited, have been given careful consideration, and have stimulated or resulted in modifications of personnel policy. By and large the membership of employee unions are genuinely and intelligently interested in promoting the merit system and the social, educational, and economic welfare of employees. They are concerned with many of the same problems with which the Office of Personnel is concerned. In a statement of objectives one union declared:

> It seeks to bring to employees an understanding of the reasons for sound administrative practices and to administrators an understanding of the employee point of view, thus hoping to promote higher morale and greater efficiency in the service rendered by the Department to the public.

The relationships of this Office with employee groups have brought us much nearer that objective.

For sale by the Superintendent of Documents, Washington, D. C. - - - - - - - Price 5 cents

REPORT OF THE CHIEF OF THE BUREAU OF PLANT INDUSTRY, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
Washington, D. C., September 15, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith a report of the work of the Bureau of Plant Industry for the fiscal year ended June 30, 1939.

Sincerely yours,

E. C. AUCHTER, *Chief.*

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INTRODUCTION

Its rich background of long-continued experimentation with soils and with field and horticultural crops enables the Bureau of Plant Industry regularly to meet requests for basic information on soil types, their physical and chemical properties, soil fertility and microbiology, cultural practices, varieties, and diseases of crops, methods of harvesting, handling, curing, storing, and shipping plant products, and factors influencing the quality of those products. These requests come from producers, shippers, dealers, processors, and consumers in all parts of the United States and from different foreign countries. Similar requests are received also from various governmental action agencies, commissions, bureaus, and services. Likewise, the results of plant research are being utilized to an increasing extent in connection with human and animal nutrition and public health.

The ability of this Bureau to supply specific information on such a wide range of subjects is largely due to the fact that it has always adopted a long-time view in its scientific program and has conducted its research accordingly. Its basic philosophy and major objectives

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have been broad, and data covering many crop seasons and localities have been collected by patient study of problems involving infinite detail.

This does not mean that all of the problems have been solved. There are many old problems still awaiting solution, and, with the intensification of crop culture in this country, new and pressing problems are constantly arising to demand research attention.

The following pages present summaries of definite progress in certain phases of the current research of this Bureau as recorded during the fiscal year ended June 30, 1939. Much additional research was continued. The more significant results have been reported in greater detail in the numerous publications listed herein. The results of other current research are in process of publication or will appear in future publications.

CHANGES IN ORGANIZATION AND PERSONNEL

Under the Secretary's memorandum dated October 6, 1938, pertaining to changes in Department organization, administration of the Federal Seed Act was transferred from the Bureau of Plant Industry to the Bureau of Agricultural Economics. Under the same authority the Soil Survey Division and the Soil Chemistry and Physics Research Division were transferred from the Bureau of Chemistry and Soils to the Bureau of Plant Industry.

With the transfer of the work under the Federal Seed Act to the Bureau of Agricultural Economics, the Division of Seed Investigations of the Bureau of Plant Industry, formerly charged with administration of the act, was discontinued, and the research functions of that Division were assigned to the Divisions of Fruit and Vegetable Crops and Diseases, Cereal Crops and Diseases, and Forage Crops and Diseases.

On April 16, 1939, P. V. Cardon, formerly principal agronomist in charge of the Division of Forage Crops and Diseases, was appointed Assistant Chief of the Bureau. H. L. Westover, senior agronomist, was designated acting head of the Division.

In line with the provisions of the Retirement Act, the following members of the technical staff were retired during the fiscal year: John W. McLane, assistant biophysicist, Division of Cereal Crops and Diseases, and Emma F. Sirrine, associate botanist, Division of Seed Investigations. Albert F. Woods was also retired as principal pathologist, Division of Fruit and Vegetable Crops and Diseases, though he continues as Director of the Department's Graduate School. Dr. Woods was appointed to the Department of Agriculture in 1898 and was Assistant Chief of the Bureau of Plant Industry from its organization in 1901 until 1910. After serving successively as dean of the College of Agriculture and director of the Agricultural Experiment Station of the University of Minnesota and as president of the University of Maryland, he returned to the Department in 1926 as Director of Scientific Work, and in 1934 he rejoined the staff of the Bureau.

CEREAL CROPS AND DISEASES

M. A. McCall, *in charge*

HYBRID CORN PRODUCTION STILL EXPANDING

The expansion in the acreage planted to corn hybrids in the last 4 years has been phenomenal. Approximate acreages of hybrid corn were 500,000 in 1935, 1,500,000 in 1936, 3,500,000 in 1937, and 17,000,000 in 1938. The Iowa Agricultural Experiment Station has estimated the 1939 hybrid-corn acreage at 65 to 75 percent of the State's entire corn acreage. Hybrids developed by the Department in cooperation with the State agricultural experiment stations, which have performed in a very creditable manner, represent an appreciable portion of the acreage. Inbred lines developed in the cooperative programs also are used extensively in hybrids produced by private commercial breeders.

CORN HYBRIDS IMPROVE QUALITY OF MARKET GRAIN

When the 1938 corn crop moved to market, hybrid corn constituted a considerable portion of the supply for the first time. Most of the corn hybrids developed by the various State experiment stations and by the Department have been more resistant to the ear- and kernel-rot diseases than the open-pollinated varieties. The high quality of the corn received at several terminal markets suggests that hybrid corn had a noticeable influence in improving the general quality of the 1938 crop.

YELLOW SOUTHERN CORN VARIETIES DEVELOPED

Two new varieties of yellow corn developed in cooperation with the Tennessee Agricultural Experiment Station were released to growers of that State in March 1939. One is a yellow strain of Neal Paymaster, an outstanding widely adapted southern variety, and should be of value in several of the Southern States. The other is a yellow strain of Thompson Prolific, an early prolific variety adapted to the Cumberland Plateau and other parts of Tennessee. Both of these new varieties should be adapted to rather extensive areas in which no suitable yellow varieties of corn are now available.

WHEAT VARIETIES RESISTANT TO RUST AND SMUT

The most severe leaf rust epidemic of recent years in the hard red spring wheat region occurred in 1938. The two new varieties, Pilot and Rival, which were bred for resistance to stem rust, are also resistant to leaf rust and to several races of bunt (stinking smut). These disease-resistant varieties, developed by hybridization in the cooperative wheat-breeding program of the Department and the North Dakota and other State experiment stations, proved to be of good bread-making quality and were distributed in 1939.

Leaf rust probably is the most serious disease of wheat in the soft red winter wheat region. Wabash, a selection from Fultz, developed in cooperative experiments at the Purdue University (Ind.) Agricultural Experiment Station, proved to be resistant to leaf rust and was released to farmers in Indiana and Illinois in 1938. Wabash also is

resistant to the mosaic disease, and it produces high yields of good-quality soft grain.

Twenty-six races or varieties of bunt have been collected in wheat-growing areas of the United States. A number of wheat varieties developed in cooperative experiments have proved resistant to several races of bunt, but, until recently, none has been resistant to all. However, some strains that are resistant to all known races have now been developed by hybridization. These are being tested for yield, quality of grain, and other characteristics.

A rust-resistant type, otherwise very similar to the well-known variety Baart, was produced by repeated backcrossing of resistant segregates from a cross between Baart and the rust-resistant Hope with the Baart parent. Simultaneously, and by the same method, a strain of Baart with the bunt resistance of Martin was produced. Baart 38, which is resistant to both rust and bunt, was then produced by crossing the rust-resistant and the bunt-resistant strains. A strain of White Federation named White Federation 38, which also is resistant to both rust and bunt, was produced in a similar manner. These two disease-resistant varieties, Baart 38 and White Federation 38, developed in cooperative experiments at the California Agricultural Experiment Station, were distributed to growers in California in the fall of 1938.

Nebred, a hard red winter variety selected from Turkey in cooperation with the Nebraska station, produces high yields of good quality grain and is very resistant to bunt. It was distributed to growers in 1938.

WHEAT PASTURE VALUABLE FOR OVERWINTERING CATTLE

Wheat pasture supplemented with sorghum stover for the entire winter and with cottonseed cake for the midwinter period has been found to be satisfactory for overwintering cattle. Experiments in western Kansas have shown the returns from wheat pasture to be much greater than the loss in yield of grain, provided the wheat is not overgrazed and pasturing is not continued too late in the spring.

TWO HARDY WINTER OAT VARIETIES DISTRIBUTED IN TENNESSEE

Two improved winter oat varieties, Fulwin (Tenn. No. 1945 and C. I. 3168) and Tenex (Tenn. No. 1884 and C. I. 3169), have been developed and distributed to farmers of Tennessee. These are cold-resistant, high-yielding, uniform strains originated at the Tennessee Agricultural Experiment Station by reselection of Fulghum (winter type, C. I. 2499), a strain furnished by the Department. The original selection from Fulghum, made at the Arlington Experiment Farm in 1920, has shown high cold resistance and high yield but is variable in plant characters. Fulwin and Tenex are among the hardiest strains of winter oats developed in this country.

NEW SMUT-RESISTANT OAT VARIETY RELEASED IN KANSAS

A new smut-resistant variety of oats, Fulton, was distributed to Kansas farmers in the spring of 1939. Fulton was selected from a cross between Fulghum and Markton in cooperative experiments at the Kansas Agricultural Experiment Station. It is resistant to the

specialized races of smut that attack the Fulghum type of oats and is a higher-yielding variety than Kanota, a strain of Fulghum that has been the standard in Kansas for many years.

NATURAL SELECTION MEASURES ADAPTATION OF BARLEY VARIETIES

The effect of natural selection in a mixture of 11 varieties of barley was studied at 10 stations over a period of 12 years. Population counts of the mixture were made annually. It was found that at all places there was a rapid elimination of the less adapted varieties. At most places the variety that would eventually dominate was quickly evident. The leading variety varied with the location of the station. A variety dominant at one station was sometimes eliminated at another. Two varieties survived at all stations. Some varieties increased for a time and then decreased. The results found have a direct bearing on the method of breeding in which hybrid populations are carried in bulk for a number of generations.

TREBI BARLEY THE OUTSTANDING YIELDER IN NORTH AMERICA

The yields of barley varieties at 120 experiment stations in the United States and Canada from 1932 to 1936 were compiled. Trebi was the highest-yielding variety at 32 stations, and Wisconsin Barbless (Pedigree 38) at 10. Leading varieties in second place were Trebi, at 13 stations, Hannchen at 10, O. A. C. 21 at 5, Vaughn and Spartan at 4, and Wisconsin Barbless (Pedigree 38) at 3 stations.

TROPICAL RICE VARIETIES BETTER ABLE TO WITHSTAND HEAT

Four varieties of rice were grown in greenhouses during the winter and spring months of 1938 at temperatures of 80°–90°, 70°–80°, and 60°–70° F., with and without artificial light. The plants grew taller with than without artificial light at all temperatures. The Caloro, Blue Rose, and Rexoro varieties with artificial light failed to head or produce seed by July 10, but Fortuna headed and matured seed at temperatures of 80°–90° and 70°–80°. The results indicate that Rexoro and Fortuna, which are of tropical origin, are better suited for growth at high temperatures than are Caloro and Blue Rose. Caloro was selected from a Japanese rice, and Blue Rose appears to have originated from a natural cross with a Japanese variety. Plants of Caloro and Blue Rose grown at temperatures of 80°–90° failed to develop satisfactory root systems.

EARLY GRAIN SORGHUMS EXTEND THE SORGHUM REGION NORTHWARD

The varieties of grain sorghum well suited to harvesting with a combine have been too late to mature satisfactorily in northwestern Kansas, western Nebraska, and eastern Colorado. The breeding of a variety to meet these requirements was undertaken at Woodward, Okla., and the most promising strains were sent to Colby, Kans., for testing under a suitable environment, in cooperation with the Kansas Agricultural Experiment Station. The best of these strains was named Colby milo and distributed to farmers in 1938. It proved to be the highest-yielding grain sorghum in the cooperative tests on farms in northwestern Kansas in that year. Because of its early

maturity, it was dry enough to be harvested with a combine successfully and for subsequent safe storage. The short stalks permitted the crop to stand without serious lodging until ready to harvest. Several thousand bushels of certified seed was distributed in 1939.

Other early varieties of grain sorghum, including Sooner milo, early Kalo (a milo-kafir hybrid), Improved Coes, and Highland kafir, developed by the Department in cooperative breeding experiments and distributed in recent years, have helped to extend the grain sorghum region some 200 to 400 miles northward. They also have furnished farmers with a source of feed grain where corn failed from drought. The acreage of these varieties has increased rapidly in Nebraska and adjacent States.

FALL-SOWN FLAXSEED INDUSTRY BECOMING ESTABLISHED IN TEXAS

Experiments with fall-sown flax were conducted by the Department at San Antonio, Tex., for many years. Recently similar tests have been under way at several points in southern Texas in cooperation with the Texas Agricultural Experiment Station. As a result of these experiments, together with an interest in flax as a fall-sown cash crop stimulated by the recent establishment of the industry in California following cooperative flax experiments there, farmers in southern Texas began growing flax on a small scale. About 1,000 acres were grown in 1938 and more than 17,000 acres in 1939. Experiments have indicated that Rio is the most productive variety for that section.

PRACTICAL METHODS FOR BINDWEED CONTROL DEVELOPED

Serious noxious weeds, including bindweed or wild morning-glory, Canada thistle, and whitetop or perennial peppercress, have increased from an estimated 2,000,000 acres in 1920 until they now occupy more than 10,000,000 acres of good farm land, and they are continuing to increase at a rate of more than half a million acres a year. Since heavily infested land becomes almost incapable of profitable crop production, this is equivalent to losses in property values of tens of millions of dollars, and in annual income of many millions more. The increase of weeds in the Western States has been due to dry weather, which favored seed production, and to economic stresses, which hindered good field work.

Since 1935 the Bureau has cooperated with the agricultural experiment stations in nine Western States in a research program on weed control, with special emphasis on bindweed. Results already obtained show that bindweed tends to exhaust its roots rather than to replenish them during the first few days of leaf growth and that there is a definite advantage in waiting until the new shoots are 4 or 5 inches tall before destroying them. In practice this means that cultivating at intervals of 14 to 21 days is more successful than cultivation every week or 10 days. This finding puts control by tillage methods on a practical basis and has resulted already in large-scale bindweed-eradication programs being undertaken under State auspices in at least two of the more badly affected areas.

Perennial weed conrol by spraying with solutions of sodium chlorate was found to result in erratic killing and to be dependent on good weather. This method is expensive and laborious and involves a

serious fire hazard. Experiments indicate that dry sodium chlorate, spread on the soil in early autumn with inexpensive equipment, kills the weeds as effectively as the spray method and eliminates almost entirely the danger of fire.

Where noxious weeds are abundant immediate complete eradication is not feasible, and farmers must be content with gradual or partial control. Cropping systems are being developed by which reasonable returns can be had from the land despite the weeds. In Minnesota a combination of winter wheat or rye alternating with fallow provides for cash returns while the weeds are being slowly destroyed. In Kansas a rotation of fallow and sorghum and in northern Idaho an alternation of fallow and fertilized wheat are promising. Through these experiments farmers are realizing that they can cope with the weeds where they cannot wholly destroy them.

COTTON AND OTHER FIBER CROPS AND DISEASES

H. W. Barre, *in charge*

WIDE ADAPTABILITY OF ACALA COTTON

Acala cotton, introduced by the Bureau from Mexico more than 30 years ago and first grown in Texas, has been bred, developed, and tested at all of the Bureau's stations in the western part of the Cotton Belt. It is recognized as the outstanding variety of upland cotton in the irrigated sections of the Southwest and is now planted on the entire cotton acreage in California. In 1937 and 1938 this variety was extensively grown in Texas and western Oklahoma, and it has proved to be well adapted to that entire area. Acala produces a staple length from 1 to 1⅛ inches and brings a premium over ⅞-inch cotton of from $5 to $10 a bale, depending on price and demand.

ROOT ROT RESISTANCE ASSOCIATED WITH CHEMICAL COMPOSITION

The isolation of 13 different alkaloids and other chemical compounds from plants resistant to phymatotrichum root rot and the study of the toxicity of 54 alkaloids to the growth of the causal fungus strongly indicate that the presence of these compounds in some plants is closely associated with resistance to the root rot. It was found that these substances that are toxic to the fungus occur in the roots in greater concentration than in the stems and leaves, and this explains in part why they protect the roots from attack.

INHERITANCE OF FUZZ AND LINT CHARACTERS

The isolation and study of naked-seed lintless characters in cotton, through cooperative effort at the Texas Agricultural Experiment Station, has brought this type of cotton to the attention of experiment station officials and commercial interests because of its bearing on the possibilities of breeding cotton exclusively for seed and oil production. This study has also indicated the effect of accumulated modifiers in increasing lint percentage on naked-seed cottons, furnishing the background for development of fuzzless-seed cottons having abundant lint. Cottons of this type have the advantages of being more easily ginned and of producing lint free from short fibers and neps and naps.

SEA-ISLAND COTTON INTEREST REVIVING

Interest in the revival of the sea-island cotton industry in the Southeastern States continued in 1938, especially in Florida and Georgia. From a harvested area of about 14,000 acres in Florida and 16,000 acres in Georgia, with small acreages each in Alabama and South Carolina, 4,273 bales were produced. Because of unfavorable seasonal conditions, boll weevil infestation, and the planting of many acres of sea-island in localities not suited to this special type of cotton, the average acre yield for the entire area was low. However, in many localities where the sea-island was well isolated from the earlier-maturing upland cotton and improved methods of culture and weevil control were applied, yields were much better and compared favorably with those obtained in preweevil days. The average price received by the growers was about 25 cents a pound, with a few bales of the better grades and staples selling for as high as 30 cents or more a pound. Assistance was given to growers on proper harvesting and conditioning of the cotton before ginning and to ginners on proper adjustments of the roller gins required for this special type of fiber. Buyers and manufacturers were very pleased with the marked improvement shown both in grades and in preparation of the 1938 crop. Sixteen organized one-variety sea-island communities in 16 counties were operating in Florida in 1938, and 4 counties voted to plant sea-island exclusively under a recent Florida State law, which provides legal protection for such areas. In close cooperation with the extension services, experiment stations, and other State agencies, especially in Florida and Georgia, assistance is being given to groups of growers in the establishment of the one-variety plan of production for sea-island cotton.

Promising new strains of sea-island, and of hybrids of sea-island and upland that combine the fiber properties of sea-island with the larger bolls, earlier maturity, and larger yields of upland varieties, are being produced experimentally, to be ready for any interest that may develop in such cottons.

STANDARDIZED PRODUCTION IMPROVES QUALITY AND INCREASES PRICE

More than 1,000 one-variety organizations, in 400 of the 850 cotton-producing counties in 14 of the 17 principal cotton States, were operating in 1938. The total planted area was about 2,300,000 acres and the production about 1,500,000 bales of improved-quality cotton with $^{15}/_{16}$- to $1^{1}/_{8}$-inch staple. It is estimated that the extra cash return received by growers in one-variety communities from larger yields and premiums averaged about $6 an acre, or a total of approximately $14,000,000, above what they would have received from the mixed, run-down stocks formerly grown. Grade and staple reports published by the Bureau of Agricultural Economics continue to show marked increase in the proportion of the total crop represented in the better lengths of staple produced in the one-variety communities. For example, the proportion of 1-inch and $1^{1}/_{32}$-inch staple, which are the predominating lengths produced in the one-variety areas, increased from 11 percent in 1928 to more than 25 percent in 1938. American manufacturers are showing marked interest in one-variety cotton, and the number of mills using this cotton from the

same one-variety areas year after year is increasing steadily. In an effort to demonstrate the superior quality of the cotton produced in one-variety communities, about 4,000 bales from the 1938 crop were shipped to foreign mills for test runs. Certified samples were taken at the gins, and the bales were wrapped in cotton bagging. Without further sampling, the bales reached Europe in a neatly packaged condition, in marked contrast to the usual ragged appearance of American bales in the markets of the world.

The aim of this work is not to increase the total volume of the annual crop, but to establish cotton growing in the United States on a quality instead of a quantity basis, with lower costs of production and better returns for American cotton farmers.

DRUG-FREE HEMP IN PROSPECT

The future of the hemp industry in this country seems to depend largely on the development of strains or varieties of hemp free from marihuana. Coordination of biological, chemical, pharmaceutical, and psychopathic studies lend encouragement to the efforts to free hemp from this destructive drug. Three inbred generations of plants grown in the field and in the greenhouse during the year and the introduction and testing of hempseed from 23 different sources from all over the world form the basis for these researches.

DRUG AND RELATED PLANTS

W. W. Stockberger, *in charge*

EPHEDRINE PRODUCED UNDER IRRIGATION

Experiments recently concluded in southern California on several species of *Ephedra*, the source of the alkaloid ephedrine widely used in the treatment of nose and throat affliction, indicate that from 1,700 to 3,200 pounds of the dried crude drug per acre can be produced under irrigation from two seasons' growth from suckers. Certain strains of these species give promise of yielding consistently over 1 percent of ephedrine.

DILL-HERB OIL PRODUCTION POSSIBLE IN VIRGINIA

Dill-herb oil, distilled from partly matured dill, is rapidly replacing the herb itself in commercial pickling. On sandy loam in eastern Virginia an experimental half acre yielded oil at a rate indicating that with closer spacing of the rows and more judicious use of fertilizer this crop may have possibilities in that section.

POTENTAL TANNIN PLANTS TESTED

Canaigre (*Rumex hymenosepalus*), a potential tannin plant, native to the Southwest, was grown experimentally in New Mexico and in 12 localities in Texas. The best yields of root were obtained in the Winter Haven and Lubbock areas in Texas, but the reasons for the better growth in these locations are not apparent. The tests in New Mexico demonstrated that in very dry regions canaigre culture is most uncertain unless irrigation is used.

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Several species of sumac (*Rhus* spp.), the leaves of which are possible commercial sources of tannin, were successfully grown from seed and from root cuttings in connection with studies on their crop possibilities.

NEW HOPS MORE RESISTANT TO MILDEW

Several new strains of the hop plant more resistant to downy mildew than any of the varieties now grown commercially have been developed and are being further tested in the field for yield and quality.

Studies completed after several years show that seedless hops now coming into increasing production on the Pacific coast compare very favorably with imported seedless hops with respect to brewing value and low seed content.

DRY LAND AGRICULTURE

C. E. Leighty, *in charge*

WATER STORED IN SOIL DETERMINES MILO YIELD

A correlation of 0.75 between the quantity of available water in the soil at seeding time and the yield of milo, shown in experiments begun 24 years ago at the United States Dry Land Field Station at Dalhart, Tex., is much higher than the correlation between the yield and the precipitation while the crop is growing. The precipitation from seeding to harvest has been less variable than that prior to seeding; consequently, poor conditions at seeding time are not often corrected by heavy rainfall during the crop season. The average precipitation during the early growing period is usually sufficient for the small milo plants, but during their period of heavy growth, late in July and throughout August, the rate of use by the crop greatly exceeds the usual precipitation. Moisture reserves in the soil are then drawn on, and the amount of stored water largely determines the growth and yield of the crop.

GUIDE TO LAND PREPARATION FOR GRAIN SORGHUMS

Results at Dalhart indicate that the land-preparation method used for grain sorghums may be profitably governed by the amount of the precipitation during the fall, winter, and early spring. When precipitation during the fall was sufficient to put the soil in good condition for plowing, fall plowing, on an average, was more productive than spring plowing. When the fall precipitation was deficient, average yields on spring plowing were higher than on fall plowing. If the fall was dry and the soil condition was not improved by rains during the winter or early spring, listing, which on the average produced lower yields than either fall or spring plowing, afforded the best opportunity of producing a crop. The less-vigorous growth of sorghums on listed land is a positive advantage in adverse years.

RESULTS OF WHEAT PRODUCTION TESTS IN OREGON

Cooperative tillage and crop-rotation studies at the Pendleton field station of the Oregon Agricultural Experiment Station during the last 8 years have resulted in several important discoveries bearing on

the economical production of wheat on the higher-producing lands of the Columbia River Basin. (1) Contrary to results obtained elsewhere on the lower-producing lands, deep (9-inch) plowing has rather consistently increased wheat yields from 2 to 5 bushels an acre over shallow (5-inch) plowing. (2) A slight reduction in yield has followed the utilization of heavy straw residues, whether plowed under or left on the surface as a protection against wind and water erosion. Light applications of nitrogenous fertilizers, either when the land is plowed for fallow or at seeding time, have corrected this effect and have slightly increased yields of wheat. (3) The available soil moisture for the growing crop usually is not greatly influenced by varying the methods of fallow cultivation. The time of plowing and the manner of cultivating the fallow does, however, affect the accumulation of nitrates in the soil, which in turn influences yields. (4) A 2-year rotation of spring wheat and peas has thus far been the most promising rotation under trial. As a result of this finding, a pea-canning industry has been established in Umatilla County, Oreg. A considerable acreage of land that previously was cropped to wheat and fallowed in alternate years is now devoted to a spring wheat and pea rotation with fallow eliminated. Although wheat yields less following peas than on fallowed land, the pea crop usually more than compensates for this.

FARM-WINDBREAK TREE PLANTINGS SHOW IMPROVEMENT

The growth of trees in experimental plantings on the northern Great Plains indicates a possible turning point in the heavy killing-back and losses that have occurred during the last few dry years. Data on growth and survival have been taken annually on several species of trees in farm-windbreak plantings in the fifth year after they were planted. Trees planted in 1929 to 1933 made progressively less growth and had lower survival each year. The 1937 data on 1933 plantings showed the lowest 5-year average ever recorded. Data collected in 1938 on plantings made in 1934 showed a slight gain over the preceding year's record. According to tests at the United States Northern Great Plains Field Station at Mandan, N. Dak., very few losses occurred and average growth increased considerably in 1938, as compared with decreases in growth and heavy losses in most species during the years 1933–37. These increases were general, except in four species of ash, which continued to kill back during the year. These four species were the last to show severe injury from the continued droughts and now are the slowest to show evidence of recovery. An average survival of 81 percent was obtained with the deciduous species set out in 1938, and a survival of 36 percent with coniferous species. Insect damage was extremely heavy on young trees during the summer of 1938 and may result in further losses later.

FORAGE CROPS AND DISEASES

P. V. Cardon, *in charge*

SOYBEAN COMPOSITION VARIES WITH ENVIRONMENT

The same variety or selection of soybeans, grown under different environmental conditions, varies markedly in percentage of oil, protein, calcium, phosphorus, and potassium and in iodine number,

according to the results of cooperative tests made in several States and in connection with the United States Regional Soybean Industrial Products Laboratory in Illinois. The Rokusun variety, for example, under different soil and climatic conditions ranged from 17.7 to 21.2 percent of oil, 39.4 to 47.8 percent of protein, and 0.26 to 0.44 percent of calcium. Similar results have been obtained with other varieties and selections. Different varieties produced under the same environmental conditions also have shown wide differences in composition.

LEGUMES BETTER THAN NONLEGUMES AS GREEN MANURE

Legumes as green-manure crops have given greater crop-yield increases than nonlegumes. Turning under entire legume plants, as compared with only the stubble, has also given higher yields of succeeding crops. Summer cover or green-manure crops not plowed under in the fall but left standing, or cut and left as a surface mulch, gave higher yields in succeeding crops than when turned under in the fall while green. Crotalaria seeded with small grains and allowed to volunteer as a green-manure crop in some parts of the South has increased the yield of grain at little additional expense and promises to be a practicable means of increasing and maintaining soil fertility.

KOREAN LESPEDEZA GOOD SUPPLEMENTAL PASTURE

Permanent bluegrass pastures supplemented with Korean lespedeza continued, in Missouri, to give greater beef gains than permanent bluegrass pastures alone, whether the latter were grazed continuously or in rotation. The gains on the permanent pastures supplemented with Korean lespedeza were 44 percent higher than the average gains on permanent pastures alone. The lespedeza was ready for grazing when the bluegrass pasture became dormant. The animals on lespedeza continued gaining in weight and maintained good flesh until the bluegrass pastures renewed growth in the fall. The animals that had no access to lespedeza during the dormant period of the bluegrass pastures lost weight during that period under continuous grazing and made only slight gains under rotation grazing.

NUMEROUS GRASSES UNDER CLOSE STUDY

Tens of thousands of individual grass plants representative of numerous species adapted to different regions of the United States were continued in a score of nurseries for close study, selection, and hybridization. The more promising types were selected and are being increased for wide testing. Several of these have shown qualities distinctly superior to those of commercial strains. Further tests in pastures and meadows are required to establish the superiority of the selected strains before distribution through commercial channels would be warranted.

FIELD PEA DISEASE DAMAGE LESS ON FERTILE SOIL

Severity of disease damage in field peas seems to be associated with soil fertility, the damage being less severe on the more fertile and more adequately fertilized soils. The need for crop rotation as a

means of controlling certain of the diseases of field peas is shown by the fact that in laboratory tests the fungus *Ascochyta pinodella* lived 17 months on dry stems. This fungus and other destructive organisms affecting Austrian Winter field peas, such as *Mycosphaerella pinodes* and *Septoria pisi*, live in the field from one crop season to the next on bits of plant tissue on the surface of the ground. The life history of all these organisms is being studied with a view to determining control measures.

STAGE OF MATURITY AFFECTS COMPOSITION OF EDIBLE SOYBEANS

Analyses of seed of 17 varieties of edible soybeans harvested at different stages of maturity showed marked changes in the amounts of different constituents as the beans advanced in maturity from the first stage (seed about one-half grown) to the fifth stage (mature). Oil increased through the first three stages and decreased at maturity. Protein decreased from the first to the second stage and then increased, being highest in the mature seed. Calcium was highest in the first stage and gradually decreased, becoming lowest in the mature stage. Starch decreased by half from the first to the final stage of maturity. Nonreducing sugars were highest in the second and final stages, whereas reducing sugars decreased from the first to the final stage of maturity.

CLOVERS RESPOND TO PHOSPHATE

Phosphate fertilizers applied to white clover in eight different localities under pasture conditions resulted in better clover stands and increased the growth of clover plants. Fair volunteer stands of native white clover developed without seeding under phosphate fertilization and close grazing. In the Southeastern States high rates of application of phosphate fertilizers appear necessary for maximum growth of various *Trifolium* species, although good stands were obtained under light applications of 50 pounds to the acre. The residual effect of high rates of application has been of short duration. In the Central States applications of limestone with phosphate fertilizers have increased both the stand and the yield of clovers.

COLCHICINE REDUPLICATES CHROMOSOMES

Reduplication of chromosomes by colchicine treatment has been effected at the United States Regional Pasture Research Laboratory in perennial ryegrass, white clover, and red clover. In perennial ryegrass the tetraploids have wider, thicker, and longer leaves, thicker culms, and fewer tillers than the diploids. Chemical analyses indicate that the tetraploids have a higher percentage solubility of the dry matter and increased percentages of reducing sugars and total sugars. Studies of meiosis in diploids and tetraploids are yielding information on the factors responsible for cytological instability in the tetraploids.

COOPERATIVE STUDIES ON PROTECTION OF ALFALFA SEED CROP AGAINST *LYGUS*

In cooperation with the Bureau of Entomology and Plant Quarantine and the Utah Agricultural Experiment Station, means are being sought to protect alfalfa against the attacks of *Lygus*, a major factor

in reducing alfalfa-seed yields in the intermountain region. An infestation of these insects tends to retard vegetative growth in the early stages and to stimulate it after the plants have come into flower. The *Lygus* also causes serious damage to buds and flowers, which prevents the setting of seed pods. It appears that much of this damage is the result of physiological disturbances in the plant induced by the insect attack. As shown by the results of cooperative studies with entomologists in Utah, dusting alfalfa plants five to seven times a week with an insecticide consistsing of 15 percent of pyrethrum concentrate and 85 percent of dusting sulfur increased seed yields to four to six times the yield from infested undusted plants. Other promising control measures include cultivation, clipping, and burning practices designed to destroy the insects or to stimulate plant growth in a manner to escape or minimize insect injury. Much damage may be averted also by timing the seed-bearing crop to set seed when the population of *Lygus* is sparse.

FOREST PATHOLOGY

HAVEN METCALF, *in charge*

HEMLOCK TWIG RUST

A twig rust of hemlock has caused thousands of dollars of damage during the last few years in commercial nurseries growing ornamental stock in North Carolina. The rust (*Melampsora farlowii*) seriously disfigures trees, rendering them unsalable. It has no alternate host and produces only a telial stage. It is much more severe on eastern than on Carolina hemlock. Investigation has shown that the spread of the disease ordinarily takes place only during May and early June in North Carolina, and that weekly spraying with lime-sulfur during May alone reduces infection to a negligible amount. The results of the work were responsible for an extensive spray program at some of the nurseries during 1939.

DECAY OF SLASH ON CLEAR-CUT AREAS IN THE DOUGLAS FIR REGION

One of the principal obstacles to permanent forestry in the Northwest is the high fire hazard characteristic of slashings. Because of the great volume of the debris left by logging operations, slash must be either burned broadcast soon after logging or left as it falls, and neither of these procedures effects a satisfactory abatement of fire hazard.

Examinations over a period of 10 years of 135 representative slashings of various ages in this region indicate that decay, on both burned and unburned slashings, is too slow to facilitate fire control materially or to cause a marked reduction in the inflammability of slash until after perennial vegetation has shaded the slash sufficiently to prevent excessive drying. It was also found that the presence of old slash is not likely to affect the prevalence of disease in future stands. Since decay of slash does not appear to be of primary significance in the reduction of fire hazard or in the health of second-growth forests, it can safely be ignored in the formulation of slash-disposal policies.

CANKER DISEASES OF DOUGLAS FIR

Cankering of young Douglas firs was common and alarming during 1936 in many localities west of the Cascade Mountains in Washington and Oregon. Although the fungi associated with the cankers were all apparently native to the region, it was evident that great damage might be caused by an even moderately aggressive parasite of young trees, since hundreds of thousands of acres had become stocked with Douglas fir during the previous two decades. However, active cankers were rare on this host in 1937; and in 1938 most of the cankers were almost or entirely healed, and killed tops were being replaced by healthy volunteer leaders. It is evident that while these particular native cankers may recur in certain years, they do not constitute a menace to the Douglas fir stand.

WESTERN RED ROT

Western red rot, a decay caused by *Polyporus ellisianus*, is responsible for considerable loss in many of the existing stands of ponderosa pine. These losses often reach 20 to 30 percent of the gross volume of merchantable timber in the southwestern and eastern Rocky Mountain regions, including the Black Hills of South Dakota, where ponderosa pine is the principal and sometimes the only commercial timber species. Fire prevention offers little or no protection against invasion by this fungus, since it rarely, if ever, enters through fire scars like many other species that cause decay. Its principal avenues of infection are branches over 1 inch in diameter that have died naturally and on which a substantial proportion of the bark remains. Recent studies have shown that very dense stands had little infection at ages as high as 70 years, because of the small size of their branches. In more open stands or in dense stands that have been thinned before reaching the age of 70, both of which are likely to have a high proportion of large branches, it was found that artificial measures against infection are practicable in conjunction with timber-stand-improvement work. These measures include the removal of infected trees or trees with large branches in thinning operations, the selection of noninfected trees or small-branched trees as crop trees even though they may not be the dominant individuals of the stand, and the pruning of all crop trees to a height of 17 feet in order to give maximum protection to the valuable first log. Little expense is chargeable to the decay-control value of the pruning, because by reducing the knots in the first log it will also increase the proportion of high-quality lumber.

A KILLING VIRUS DISEASE OF ELMS

Phloem necrosis of elms is the first epidemic killing disease of forest or shade trees proved to be of virus origin in the United States. After thousands of unsuccessful attempts over a period of years to establish its origin as fungus or bacterial, the disease was finally transmitted to healthy American elms by grafting them with patches of bark, with branch scions, and with root scions from diseased trees, thus indicating that the disease is of virus nature and systemic. This striking and puzzling disease of elms has been spreading in the Ohio River Valley for some years. In Chillicothe, for example, over half

of the elms have died in the last 3 years. First indications of the disease are slight shriveling and brittleness of the leaves. These are followed by rotting of the roots and discoloration of the cambium and the phloem. An affected tree may die within a few months after symptoms become noticeable.

LETHAL WILT DISEASES OF FOREST AND SHADE TREES

Wilt diseases that kill forest and shade trees are becoming increasingly important. These wilts are due to fungi or bacteria that invade the sapwood and cause the plugging of the vessels or release poisons into the tree. Thus they cause the discoloration or wilting of the leaves. Eventually the leaves fall, the twigs die back, and in many cases the whole tree is killed.

The elms around New York City are suffering extensively in this way from the attacks of the Dutch elm disease fungus (*Ceratostomella ulmi*), which is carried from diseased to healthy trees by bark beetles. Similar but less serious symptoms are developed in elms from attacks by a *Dothiorella* and a *Verticillium*.

The American persimmon, valuable for certain specialty products, for wildlife food, and as a soil-conservation tree, is dying in the Southeastern States from the same kind of attack by a *Cephalosporium*. The minosa wilt in the Southeast, caused by a *Fusarium*, is spreading and killing many specimens of mimosa, an esteemed shade and ornamental tree.

Even the immediate dying of pines attacked in the extensive bark-beetle epidemics is really caused by wilt fungi related to the Dutch elm disease fungus and, like that fungus, inoculated into the tree by beetles.

A disease of this same type, which has not yet reached North America, is the "watermark" disease caused by *Bacterium salicis*, which is killing several species of willows in Great Britain and adjacent contintental Europe.

FRUIT AND VEGETABLE CROPS AND DISEASES

H. P. Gould, *in charge*

PROGRESS IN SOLUTION OF APPLE-PRODUCTION PROBLEMS

Practical control of biennial bearing of apples has been obtained under northwestern conditions by early fruit thinning. Proper adjustment early in the season of the quantity of fruit to the leaf system of the tree has resulted in sufficient bloom the following spring with a minimum reduction of the current crop. Similar experimental work under eastern conditions has not given uniformly favorable results.

It has been found possible by leaf analyses to estimate the approximate level of available potassium in apple orchards. This method furnishes a rapid test for possible deficiency that will be of practical usefulness in determining, before the trees show symptoms of potash hunger, whether or not potash fertilizer material is needed.

TREE-FRUIT BREEDING ORGANIZED ON NATION-WIDE COOPERATIVE BASIS

During the year the apple-breeding work of the Department and of nearly all the actively interested State agricultural experiment

stations was thoroughly organized as part of a national fruit-breeding project for the development of a coordinated program of hybridization, exchange of materials, and testing under a wide range of conditions. This step will make for increased effectiveness and progress in tree-fruit breeding work throughout this country.

The Waite pear, a highly blight-resistant seedling developed in the earlier hybridizing work, was released to nurserymen for propagation. This variety is of good texture and quality and is particularly desirable for canning. The Close apple, a very early red variety, was similarly released.

STONY PIT OF PEAR PROVED TO BE A VIRUS DISEASE

Budding and other transmission experiments have shown that stony pit, "oak-bark," or veinlet clearance, a disease of pear in the Pacific Coast States, is caused by a virus that spreads slowly through the tree after an incubation period of nearly 2 years. This is apparently the first pear disease proved to be of virus origin. It is of considerable economic importance in orchards of Bosc and Anjou varieties in the Northwest, and a number of other varieties are susceptible. Bartlett is tolerant or immune. Nursery propagation from diseased trees is an important means of spread.

NEW PEACH AND PLUM VARIETIES INTRODUCED

As a result of the fruit-breeding work that has been under way in California, three new peach varieties were named and introduced in 1938. These are the Penryn, an early yellow freestone shipping variety; the Farida, an early cling suitable for either shipping or canning; and the Nestor, a drying variety having the drying qualities of the Muir but better tree characters. The Padre plum, from a cross of Wickson and Santa Rosa, has also been introduced.

PHONY PEACH VIRUS FOUND ONLY IN WOOD OR ROOTS

Final observations on certain transmission experiments with phony disease of peach show that the causative virus, known since 1928 to be localized in the roots, is absent from the bark and is confined to the woody cylinder of the roots. Some portion of wood must be included in the graft inoculum taken from roots affected with phony disease in order to transmit the disease to the roots of normal peach trees; bark used alone for grafting does not transmit the infection. This is the first instance among virus diseases of woody plants in which such type of localization has been demonstrated. It has been found possible to inactivate the phony peach virus in nursery plants by the use of heat treatments.

FOUR NEW STRAWBERRY VARIETIES INTRODUCED

Four strawberry selections were named and introduced: the Northstar, characterized by firm, showy, high-flavored berries; the Fairmore, by its vigor, earliness, firmness, and fine flavor under eastern North Carolina conditions; the Daybreak, by its vigor, earliness, and high flavor; the Eleanor Roosevelt, by its large size and showy fruit of high quality. Steady progress is being made in testing other

promising selections, and stocks of several are being propagated for later introduction. It is worthy of note that the Blakemore strawberry, introduced only 10 years ago, is now the leading variety in the United States.

A NEW PAPAYA VARIETY DEVELOPED THROUGH BREEDING

A new variety of papaya, developed by close inbreeding, has been introduced under the name Fairchild. It has excellent dessert and shipping qualities. The development of standard varieties of papaya is a relatively new thing in subtropical horticulture. Ordinarily plantings are made of seedling trees, and the fruit varies greatly in size, shape, meatiness, flavor, and other characters. Successful commercial production must be based on the production of highly uniform fruit with desirable qualities.

CULTURAL PRACTICES CONTRIBUTE TO PROFITABLENESS OF PECAN ORCHARDS

Investigations on premature dropping of pecan nuts have shown that orchard sanitation measures give effective and economical control. These consist in raking and composting all old shucks and leaves in the fall and in picking up and destroying dropped nuts twice a week from the first of June to the middle of August. With cheap labor the cost was about $1.25 an acre. The percentage of nuts dropping was greatly reduced, shuckworm injury was cut more than half, the degree of filling was improved, and yields were greatly increased.

Biennial bearing habit of pecan trees can be overcome to a considerable extent by following a well-rounded cultural program which includes winter cover-cropping with legumes and rye, applications of a properly balanced complete fertilizer, summer cultivation, and a spray program for control of scab, leaf diseases, and insect pests. Under such operation a profit has been made each year for the last 4 years from an experimental pecan orchard. Heavy crops of nuts were harvested every other year, with alternating medium crops.

On good soil and with good treatment, careful cost records show that a bearing pecan orchard intercropped with cotton gave about 50 percent greater combined profits than cotton alone, as well as greater profits than resulted from any other system of orchard management.

TWO NEW ALMOND VARIETIES RELEASED TO NURSERYMEN

After extensive testing, two new almond hybrid varieties, Jordanolo and Hapareil, have been released to commercial nurserymen. The Jordanolo has superior quality and should serve to regain a special fancy market that has been lost to American growers because of the lack of a suitable variety to meet this demand. The Harpareil will fill a medium-class demand better than Ne Plus Ultra now does. They both require interplanting with other varieties for effective pollination.

A NEW SPRAY IS EFFECTIVE AGAINST WALNUT BLIGHT

Further tests of the efficiency of a new walnut blight spray, namely, copper oxalate, indicate that this preparation used at the rate of

3 or 4 pounds to 100 gallons of water is even more effective than 4–4–100 bordeaux mixture in the control of bacterial blights of filbert and of walnut and is not injurious to the foliage.

TWO NEW LETTUCE VARIETIES INTRODUCED

A new variety of lettuce, from a cross between Hanson and Mignonette, was introduced last spring under the name Hansonette. It is early, dark green, and relatively sure-heading, and shows promise of adaptability to the eastern part of the United States. Another new lettuce variety, Imperial No. 850, was formally introduced to the trade. It is adapted for conditions in the central California and Arizona lettuce-producing sections in late spring or early fall, since it heads well under fairly high temperatures and is more resistant to tipburn than the varieties commonly used in these sections. Imperial No. 44 lettuce, released in 1938, has proved to be very satisfactory under a wide range of conditions in the Eastern States, particularly on the muck soils of New York and in the Sanford, Fla., district.

TWO TOMATO VARIETIES VALUABLE FOR SPECIAL ADAPTATIONS

Tomato variety trials in the central Great Plains area have brought to light two outstanding varieties. The Danmark proves valuable in its present state of development because of exceptional adaptation for fruit setting in this area where adverse climatic conditions often cause almost total failure of tomato fruit setting. This variety is also valuable as parent material in crosses designed to add more color to present-day varieties. Johannisfeuer, although almost totally unfit for use in its present state of development because of the roughness of its fruit, has been found to be the earliest of the 300 varieties thus far tested. As a potential source of earliness in breeding work, it has shown itself to be far more valuable than Earliana, which has been a standard parental source for this character.

AN EARLY PUMPKIN FOR SHORT-SEASON REGIONS

An early-maturing variety of pumpkin, Early Cheyenne, has been introduced to the trade. It is of small size and good quality and is earlier than any good pie pumpkin now offered in the trade. It is particularly suited to the high altitudes and extremely short growing seasons of the central Great Plains, where it was developed through breeding and where ordinary pumpkin varieties will not mature.

BLOOMING OF EASTER LILIES CAN BE MORE EFFECTIVELY CONTROLLED

It has been found that Easter lilies may be brought into bloom at almost any time of the year provided the bulbs are given the requisite preplanting low-temperature treatment as a primary control. After planting, the forcing temperatures are used in the usual way as a secondary control. Domestic bulbs grown in the South and dug in late July were brought into bloom before Christmas. The only previous means for obtaining bloom at that season was to plant bulbs that had been stored for 6 to 8 months, and such storage always greatly reduced the number of flowers to the plant.

A NATIVE SHRUB FOUND TO BE VALUABLE

In tests of native plant material for usefulness in the central Great Plains, *Fallugia paradoxa*, a small wild shrub of New Mexico and southern Colorado, has proved to be hardy all over the region and valuable not only as an ornamental but also in the prevention of soil erosion. It was sent in exchange to institutions in southern California and is regarded there as one of the most promising and valuable shrubs adapted to that section.

REGULATION OF LIGHT PERIODS CAUSES SEED PRODUCTION IN POTATO

Photoperiod studies with potatoes showed very definitely that plants will flower abundantly and produce seed well under controlled greenhouse conditions when given supplementary light. In general a 16-hour day has proved best, but potato varieties and strains differ somewhat in their light requirements. Initial flower primordia are laid down under all light conditions. A favorable period of light prevents premature shedding of buds, flowers, and seed balls.

NEW POTATO VARIETIES DEVELOPED IN NATIONAL BREEDING PROGRAM

Through the cooperative work under the national potato-breeding program, the Pontiac variety has been introduced by the Michigan Agricultural Experiment Station. This is a selection from a Triumph × Katahdin cross, made originally by the Department. It is a red variety showing vigor and high yield, especially on muck soils. In Iowa it has made a good record for heat tolerance, yield, and cooking quality. Mesaba and Red Warba, also recently developed in the potato-breeding program, are promising early varieties. The former is practically immune to two of the most common virus diseases of potato.

GAS TREATMENT SUCCESSFUL IN FRUIT TRANSPORTATION AND STORAGE

In storage fumigation tests with sulfur dioxide to inhibit mold growth in Emperor grapes, it was found that frequent light fumigations were more effective than less-frequent and more-toxic ones. Successful storage during 10 weeks resulted from weekly fumigations at about one-fifth the concentration of normal initial fumigation.

The use of carbon dioxide treatment in transit to supplement ordinary refrigeration was successful in freight shipments of sweet cherries from the Northwest. Since cherries usually move by express, this demonstrates the possibility of a substantial saving in transportation costs. Storage experiments with apples gave continued evidence of the usefulness of prestorage treatment with carbon dioxide in preventing soft scald and soggy break-down and in improving the quality of the fruit as well as in prolonging its storage life. This treatment also gives favorable effects in the control of common scald, Jonathan spot, and internal break-down.

IMPROVEMENT IN METHOD OF SHIPPING ORANGES UNDER VENTILATION

In transcontinental-transportation tests with oranges under ventilation, better transit temperatures throughout the load as a whole were obtained by closing the bottom bunker openings through which

the air normally enters the loading space, thus forcing the air to circulate through the top bunker openings. This reverses the usual direction of air movement and cools the load from the top downward, thus tending to prevent excessive cold in the lower layers. With this method it was found possible to leave ventilators open and permit fruit to continue to cool until outside temperatures drop as low as 20° F. during the first 3 or 4 days; afterwards the ventilators can be kept closed until the destination is reached. With the present method it is necessary to close the ventilators as soon as the outside temperature drops to 32°, as a precaution against freezing. In consequence it frequently happens that a "ventilated" shipment is cooled but little if any during transit.

PREVENTION OF DECAY IN NEW POTATOES

In studies on the so-called sunscald of new potatoes, it was found that the trouble is in reality a bacterial soft rot that starts at points of injury. The causal organism has not yet been definitely identified. The longer the potatoes are exposed to the sun before being picked up, the greater the amount of subsequent decay. The decay is arrested by storage at temperatures below 70° F. and is accelerated by higher temperatures. The findings indicate the importance of picking up new potatoes as soon as they are dug and quickly cooling them to a temperature of 70° or lower. This decay has not been troublesome on potatoes allowed to mature the protective skin before being dug.

TWO NEW FUNGUS DISEASES AFFECT VEGETABLES ON THE MARKET

The cause of a destructive decay of Winter Queen watermelons on the market was found to be *Phytophthora capsici*. This fungus is capable also of infecting peppers, tomatoes, apples, cantaloups, cucumbers, squash, and carrots. It was found that the decay can be controlled by holding produce at temperature of 45° to 50° F. or lower. A new disease of Texas-grown spinach was found on the New York market. It is caused by *Albugo occidentalis*, a fungus previously known only on weed-plant relatives of spinach.

METHODS OF HANDLING SWEETPOTATOES FOR STARCH MANUFACTURE

In the latitude of the southern half of Mississippi it has been found practicable to leave sweetpotatoes intended for starch manufacture in the soil undisturbed for as long as 6 weeks after the first frost. This will relieve gluts at the starch plant and help to prevent losses in the raw stock. Storage studies have demonstrated the feasibility of common storage for periods of at least 3 months after digging, either without curing or after only very short curing periods.

MYCOLOGY AND DISEASE SURVEY

H. A. Edson, *in charge*

NEW MATERIAL ADDED TO MYCOLOGICAL COLLECTION

The mycological collections of the Bureau, including associated units, now total 400,274 specimens, an increase for the year of over 15,000. New material has been obtained through field work, exchange, purchase, and by deposit from other divisions of the Bureau.

Supporting indexes and files have been maintained, permitting a maximum of mycological service.

In collaboration with the Bureau of Entomology and Plant Quarantine, studies have been made of the correlation between the outbreak of fungus diseases of insects and the chemical composition of the food of the insect hosts. Experiments on the transmission of fungi through insect eggs and by other means have been concluded, and the results are being prepared for publication.

The genus *Taphrina* as it occurs on the maples of this country has been monographed, including description of three new species. These fungi are of direct economic importance because of the serious leaf blights produced on their several hosts. Among the anthracnose fungi, 12 new species have been described as a further step toward a monographic account, and many new data have been assembled on the forms causing diseases of citrus, avocado, lima bean, violet, peanut, sweetpotato, tea, and other economic tropical plants.

PLANT-DISEASE SURVEY ADVANCES

The survey of cotton-seedling diseases and boll rots, carried out in cooperation with the Division of Cotton and Other Fiber Crops and Diseases and the cotton-producing States of the Southeast and controlled by laboratory examination and culture, yielded important information, which promises to be of considerable practical value. The predominant causal agent in both types of disease proved to be the anthracnose fungus, which is amenable to seed treatment.

Volume 22 of the Plant Disease Reporter, concluded during the year, contained 499 pages of selected reports and comments on the occurrence, distribution, and symptoms of plant diseases of particular interest to plant pathologists and extension workers. This publication is believed to render valuable service to agricultural workers, approximately 900 of whom indicated in response to a recent circularization of the mailing list that they do not wish to be without the service rendered through its pages.

OPTIMUM COMPOSTING CONDITIONS FOR MUSHROOMS

Studies on composting, one of the most important phases of mushroom culture, under controlled conditions of temperature, aeration, and humidity, indicate clearly that mushrooms grow best following a high-temperature fermentation of 120° to 140° F. under aerated conditions. It has been shown also that these composting conditions are not only favorable in themselves but act to correct detrimental effects brought about by anaerobic composting or at temperatures over 150°.

NEMATOLOGY

G. STEINER, *in charge*

FACTORS DETERMINING EFFICIENCY OF NEMATOCIDES

Progress has been made in the search for effective substances for the control and eradication of noxious nematodes, to the extent of determining some of the factors and conditions involved. It has been found that the protective integumental covers of nematodes consist of lipoidal cholesterol and waxy substances. If therefore a chemical

is to act on the nematode through its protective integument, it must be able to dissolve or permeate the waxy covers. It further appears that to be an effective soil nematocide a substance must be soluble in water. Experience has shown that substances having such low solubility that at 20° C. only 1 part or less in 1,500 will be dissolved are ineffective. On the other hand, compounds of high water solubility (1: 5.5 and above) proved also to be ineffective at a certain distance from the injection point, since they tend to saturate the surrounding soil water before dispersing. Moreover, substances with a boiling point higher than 150° were found to be ineffective because they seem not to exert sufficient vapor pressure to be satisfactorily dispersed in the soil. Again, substances with a boiling point below 75° appear ineffective, obviously because of too-high vapor pressure. This latter feature, however, may be corrected to some extent by the use of soil covers after the application of the chemical. It can be seen that a knowledge of these various factors limiting the nematocidal properties of a compound is of great help in the study and selection of test substances.

Progress was also made in understanding some of the factors of the soil itself that govern the efficacy of nematocides. Soils differ widely in their physical and chemical reactions to nematocides, and the condition of any one may vary greatly at different times because of changes in climatic factors. Water content and water capacity were found to be governing items of great significance. High water content lowers the efficacy of nematocides because it apparently lowers their concentration, eventually below the lethal level. Speed, amount, and direction of water flow also exert their influence. A heavy rain following an application may wash a nematocide away before it has time to act, or may lower its concentration to a noneffective level. Temperature, too, is an important factor. Satisfactory results with a nematocide depend largely on a careful study and analysis of its nematocidal properties and the numerous climatic and soil factors conditioning its efficacy.

CONTROL OF ROOT KNOT NEMATODE ON TUBEROSES

Experiments over a number of years, in cooperation with the Bureau of Entomology and Plant Quarantine, the North Carolina Department of Agriculture, and a grower, proved the standard hot-water treatment (118° F. for one-half hour) for the control of the root knot nematode to be insufficient for ridding tuberoses of this pest. However, the dormant tuberose was found to be tolerant to a hot-water treatment of 126° for one-half hour, which also controlled the nematode. Treatments on a commercial scale at this temperature made before planting gave satisfactory results, and this treatment is now recommended to growers as a routine procedure.

PLANT EXPLORATION AND INTRODUCTION

B. Y. Morrison, *in charge*

EXPLORATION FOCUSED ON BREEDING MATERIAL

In the search for desirable plant material for introduction, attention is still focused upon plant genetic and breeding problems within the Bureau, with special regard to the staple vegetable crops. As

was the case last year, the tomato and its allies received major attention. The plant introductions during the year totaled 3,791.

Preliminary tests were made for various collections of species and horticultural clones of ornamentals, particularly *Rhododendron* (azalea), *Philadelphus*, and *Deutzia*. Continued studies were made on bulbous plants from South Africa, and important botanical and cultural data were obtained. Important additions were made to several collections under generic study in the field of succulents.

In the experimenter's service a much larger amount of material was placed in the hands of institutions and nurserymen than previously. The plant materials released during the year, in the form of plants, seeds, bud sticks, cuttings, roots, and tubers, amounted to 118,488 items.

HEVEA CLONE RESISTS LEAF DISEASE

In the rubber production and breeding investigations a clone of *Hevea* that is resistant to leaf disease was isolated and a large population of hybrid *Hevea* seedlings established. Tapping tests were initiated in Florida.

Several species of palms have been given extensive propagation, and one species new to science has been brought into cultivation.

FIFTY THOUSAND SPECIMENS ADDED TO HERBARIA

The taxonomic services of this Division to the National Herbarium, the Soil Conservation Service, the Forest Service, the Indian Office, and the National Park Service continued to increase, with more than 45,000 specimens and nearly 5,000 seed specimens added to herbaria. Particular service in both field and herbarium has been furnished to the Division of Forage Crops and Diseases.

In the botanical investigations 22,001 specimens were identified.

NATIONAL ARBORETUM IMPROVEMENTS

Important work on the National Arboretum consisted of the clearing and fencing of the recently acquired land parcels, the extension of the cultivated land areas, the building of two artificial lakes within the property, the increase of the plants in the nursery, and the building of various small service buildings for the nursery unit.

During the year 16,247 specimens were received for permanent filing in the herbarium of the National Arboretum, making the total number of specimens in the herbarium 135,488.

SOIL CHEMISTRY AND PHYSICS

H. G. Byers, *in charge*

SELENIUM IN SOILS

Additional seleniferous areas were found in Idaho and North Dakota. Definite areas had not previously been demonstrated in these States. Surveys of selenium in commercial grains were made in parts of Colorado, Kansas, Nebraska, South Dakota, North Dakota, Wyoming, and Montana. These samples were collected from elevators and terminal points for receiving grain from general areas thought to be affected. Approximately 1,500 samples were obtained and

analyzed. A few samples have been found with selenium contents ranging from 4 to 12 parts per million.

Experiments with the growth of millet in pots of soils, sands, and sand-soil mixtures show that the soil colloids have a marked effect on the availability or toxicity of the selenite ion. The effect varies with the kind of colloid present, and the toxicity of the selenite is not affected by the sulfate supply, provided sufficient sulfate is available for maximum growth.

MINOR ELEMENTS IN SOILS AND VEGETATION

The barium content of wheat and corn grains growing on high-barium soils was only 8 to 10 parts per million; tree leaves reached a maximum of 600 parts, and a sample of alfalfa was highest, having 1,254 parts per million. The boron content of 11 kinds of plants was from 14 to 61 parts per million of boron soluble in strong phosphoric acid. Some of these plants showing boron-deficiency diseases had considerably lower boron content than normal plants. All soils contain arsenic in quantities varying from 0.3 to 40 parts per million. The arsenic content of normal vegetation is less than 3 parts per million, often less than 0.1 part. It appears that plant growth is normally limited by the presence of arsenic before injurious quantities are absorbed.

CHARACTERISTICS OF VARIOUS SOIL GROUPS

Examination of the mechanical analyses of the Memphis, Granada, Calloway, and Henry soils reveals that textures may be identical in the hardpan and nonhardpan members of these series. Percolation and wetting rates are widely different in these soils. The removal of free iron oxides from colloids eliminates the differences between them.

Minerals present in the colloidal fraction of 15 soils from continental United States have been identified and their amounts estimated by use of chemical, X-ray, and thermal methods. Kaolinite, together with free oxides and hydrous oxides of iron, were the predominant components of the colloids of the Red Podzolic soils examined. Gray-Brown Podzolic soil colloids contained these minerals associated with considerable amounts of hydrous mica. Single examples of colloids separated from soils of the Chernozem, Prairie, and Desert great groups differed considerably from those mentioned.

DEVELOPMENTS IN SOIL PHYSICS

A group of carefully selected soils has been subjected to mechanical analysis, and the various samples have been classified by about 40 different soil technologists using field technique. The agreement is not good, but such data serve to indicate the value of soil mechanical analyses as a check against field judgment. As the work is extended the data will become still more effective for this purpose.

Investigations of the settling volumes of soils and their colloids indicate that thixotropic properties bear an important relation to soil behavior and influence such important factors as tilth, erosion, and various water relations.

The thermal conductivity of dry soil depends primarily upon the porosity with which the soil is packed.

SOIL FERTILITY INVESTIGATIONS

OSWALD SCHREINER, *in charge*

PECAN SOIL FERTILITY MAINTENANCE

By studies of soil and nutrient solutions it is possible to recognize symptoms of nutrient deficiency in pecan trees and their foliage. Definite color and disfigurement characteristics develop as the result of a deficiency of zinc or boron in the soil. A deficiency of many of the plant nutrients, such as calcium, phosphorus, magnesium, manganese, and copper, results in dwarfed foliage and retarded growth. By means of chemical analysis of pecan tree leaves, soil deficiencies have been recorded. The addition of the major, secondary, or minor plant nutrients to less fertile soils results in an increased quantity of the elements in the leaves, which indicates that an analysis of the leaves may be a guide in determining the nutrient requirement of the soil for pecans. Recommendations based on field and laboratory experiments are made, in a report recently issued, for pecan-orchard management and fertilizer practice contributing to the profitable production of pecans.

RELATION OF SOIL-FERTILITY FACTORS TO COTTON ROOT ROT

Correlated field and laboratory studies with cotton on soils infested with root rot showed that various plant parts, as well as the whole plant considered as a composite, reflect in composition the effect of fertilizer treatment, crop residues turned under, and crop management. In turn these effects on plant composition are correlated with the mortality of cotton from root rot. Nitrogen fertilizers applied to soil where cotton is grown year after year tend to reduce mortality and increase the various nitrogenous fractions of the plant, especially in the root bark. High-phosphate fertilizers increase root rot and also increase the phosphorus content of the root, especially of the stele. Turning cane residues under preceding cotton stunts the growth of the cotton and reduces both the yields and the mortality due to root rot, but nitrogen supplements restore yields and the benefit of some reduction of mortality is retained.

GREEN-MANURE STUDIES IN THE SOUTH

Studies of soil improvement by means of crop rotation and green-manure crops, in progress in North Carolina, South Carolina, Georgia, and Texas, are showing results indicating that while it is necessary for best results to use commercial plant foods on the green-manure crops, the fertilizers used on the cash crops that follow can be materially reduced. One-half the amount of nitrogen required to grow maximum crops of cotton and corn on these soils can be saved by growing and turning under a legume crop the preceding winter. Summer legumes turned under in the coarse-textured southeastern soil decompose, and the plant foods released are leached away before the following spring unless conserved by a winter crop for green manure.

Detrimental results from the turning under of sorghum, a crop used frequently for soil improvement in the south-central Cotton Belt, are overcome by the addition of small amounts of nitrogenous

fertilizer. The combined treatment improves fertility and crop growth. Experiments on a number of soil types and in wide areas definitely show that it is necessary to fertilize cover crops for best results.

FERTILIZER PLACEMENT

Results obtained in recent years in research work on the proper placement of fertilizer have shown that fertilizer is rendered more efficient when applied near the seed but not in direct contact therewith. A band on each side of the seed row, approximately 2 inches from the seed and slightly below the seed level, has proved superior for most crops. Studies with the potato show that when the nitrogen and potash materials are placed on each side of and the phosphate in contact with the seed piece, best results are obtained with a marked increase of fertilizer efficiency over that produced by side placement of the complete mixed fertilizer.

PHOSPHATE AVAILABILITY

Research work with different phosphatic materials has shown that raw phosphates, even when in a colloidal state of division, are not nearly so effective in promoting crop growth as the more soluble superphosphates. It has been found that different crops vary in their response to the less soluble phosphatic materials. The less available materials, such as ground rock phosphate and colloidal phosphate, may prove economically effective in the development of pastures and other long-term cropping systems in which immediate availability of the applied phosphate is not so essential as in the case of annual crops.

SALT-WATER FLOODING OF FARM LAND

The destructive hurricane in the fall of 1938 flooded with salt water much valuable land on Long Island, N. Y., utilized for the production of truck crops. The effect was to add sea salts, principally common salt, to the soil. The Farm Bureau and the Bureau of Plant Industry cooperated in collecting and examining soil samples from a great many contaminated fields. The study enabled the cooperating agencies to make recommendations as to what crops should be grown and how to treat the land where an excessive amount of salt was present, thus allaying the apprehensions of the growers that their land was permanently lost to cropping.

SOIL MICROBIOLOGY

CHARLES THOM, *in charge*

SOIL ORGANISMS STUDIED AND CLASSIFIED

The comparative study and identification of soil organisms and groups of organisms is fundamental to investigations in the field of soil microbiology. Large collections of soil fungi brought together in field studies have necessitated the comparative examination of groups of related organisms and a search for improved bases for separation into strain groups or species. In this work the detailed structure of the ascospore as a means of classifying certain of the

Aspergilli has been developed. The taxonomy of the *Aspergillus nidulans* group has been worked out and reported. The development of a chemical method of inducing variation in common molds under controlled conditions offers a new line of attack upon problems of relationship among the fungi, and of obtaining special organisms for special purposes.

Work on the spore-forming soil bacilli has been continued. A report on the taxonomy of the mesophilic bacteria was made to the Soil Science Society, and the influences that lead to the production of black pigment in certain of these organisms have been defined and reported.

LEGUME-BACTERIA CULTURES SHOW HIGH QUALITY

The testing of commercial samples of nodule-bacteria cultures for inoculating legumes, representing a cross section of the retail distribution of this type of material, indicates that quality has never been better than during the past year. Out of nearly 600 official samples tested under greenhouse conditions, less than 5 percent were found to be unsatisfactory—less than one-third of the number so found in the preceding year. Field tests involving 7 common varieties of soybeans confirmed in general the greenhouse findings with regard to the soybean cultures of nodule bacteria.

HONEYLOCUST MAY NOT FIX NITROGEN

The honeylocust (*Gleditsia triacanthos*), grown under controlled greenhouse conditions, gave no evidence of having fixed atmospheric nitrogen by association with bacteria either from roots or from soil around its roots. If further studies confirm this finding, *Gleditsia* is not to be regarded as a nitrogen-fixing plant.

SOIL SURVEY

CHARLES E. KELLOGG, *in charge*

SOIL SURVEY MAPS TOTAL 1,456

The Division of Soil Survey made detailed surveys covering more than 11,000,000 acres, in cooperation with 31 States. In addition, about 5,000 square miles were mapped in reconnaissance, and several maps and investigations were made for other bureaus of the Department and for other Departments of the Government. Thirty-two printed reports with maps, representing surveys previously made, were issued, bringing the total of published surveys from the inception of the work up to 1,449. At the close of the year 34 reports of previous surveys were in press, 108 were in various stages of preparation for printing, and 64 surveys were in progress in the field.

In response to the need for soil maps for planning rural land use adjustment, the maps being made now are considerably more detailed than former ones. The large public demand for this type of research is reflected in the increased contributions toward the cooperative work by State research agencies.

The progress of soil surveying and mapping is shown in tables 1 and 2, and the reports published during the year are shown in the list that follows the tables.

TABLE 1.—*Individual areas surveyed and mapped in detail during the fiscal year 1933*

State	County or other unit	Area surveyed	
		Square miles	*Acres*
Alabama	Autauga County	163	104,320
	Elmore County	[1] 433	277,120
Arizona	Sulphur Springs Valley area	119	76,160
California	Los Banos area	441	282,240
	Newman area	295	188,800
	Stockton area	640	409,600
Colorado	Akron area [2]	[1] 29	18,560
Florida	Alachua County	[1] 198	126,720
	Collier County	[1] 52	33,280
Georgia	Candler County	[1] 142	90,880
	Towns County	181	115,840
	Union County	[1] 74	47,360
Idaho	Idaho Falls area	[1] 128	81,920
Indiana	Franklin County	[1] 307	196,480
	Noble County	48	30,720
	St. Joseph County	460	294,400
	Tippecanoe County	47	30,080
	Vanderburgh County	180	115,200
Iowa	Allamakee County	[1] 187	119,680
	Lucas County	143	91,520
Kentucky	Graves County	158	101,120
Maine	York County	[1] 349	223,360
Michigan	Midland County	[1] 181	115,840
	Newaygo County	216	138,240
	McLeod County	115	73,600
Minnesota	Rock County	[1] 263	168,320
	Washingron County	[1] 63	40,320
Missouri	St. Charles County	[1] 513	328,320
Montana	Big Horn River Valley area	91	58,240
Nebraska	Cherry County	[1] 1,724	1,103,360
New Hampshire	Hillsboro County	[1] 357	228,480
	Strafford County	149	95,360
New York	Dutchess County	325	208,000
	Schuyler County	47	30,080
	Tioga County	447	286,080
North Carolina	Haywood County	205	131,200
	Jackson County	[1] 145	92,800
	Mitchell County	[1] 146	93,440
	Yancey County	131	83,840
Ohio	Tuscarawas County	[1] 72	46,080
Oklahoma	Creek County	[1] 59	37,760
	Noble County	[1] 395	252,800
	Okfuskee County	[1] 264	168,960
	Pottowatomie County	99	63,360
	Woods County	[1] 335	214,400
Oregon	Astoria area	[1] 53	33,920
	Baker area	[1] 79	50,560
Pennsylvania	Crawford County	[1] 322	206,080
	Fayette County	[1] 173	110,720
Rhode Island	Providence County	[1] 65	41,600
South Carolina	Charleston County	[1] 316	202,240
Tennessee	Bedford County	[1] 210	134,400
	Claiborne County	76	48,640
	Decatur County	174	111,360
	Grainger County	90	57,600
	Rhea County	[1] 176	112,640
Texas	Cherokee County	35	22,400
	Dimmit County	[1] 323	206,720
	Uvalde County	48	30,720
Utah	Beryl-Enterprise area	[1] 80	51,200
	Provo-Lehi area	[1] 231	147,840
Virginia	Lee County	298	190,720
	Princess Anne County	[1] 21	13,440
	Scott County	[1] 494	316,160
	Smyth County	[1] 100	64,000
Washington	King County	[1] 627	401,280
	Lewis County	84	53,760
	Pierce County	[1] 514	328,960
	Skamania County	[1] 247	158,080
	Whatcom County	78	49,920
	Yakima County	[1] 213	136,320
Wyoming	Campbell County	[1] 1,211	775,040
Total		17,454	11,170,560

[1] These figures do not include portions of these areas surveyed in previous years.
[2] Previously reported as Washington County, Colo.

TABLE 2.—*Total areas surveyed and mapped in the several States since the inception of soil surveys*

DETAILED SURVEYS

State or Territory	Work during fiscal year 1939	Work previously reported	Total [1]	
	Square miles	*Square miles*	*Square miles*	*Acres*
Alabama	596	60,916	61,512	39,367,680
Arizona	119	5,237	5,356	3,427,840
Arkansas		15,547	15,547	9,950,080
California	1,376	41,254	42,630	27,283,200
Colorado	29	7,132	7,161	4,583,040
Connecticut		1,704	1,704	1,090,560
Delaware		2,276	2,276	1,456,640
Florida	250	15,750	16,000	10,240,000
Georgia	397	37,016	37,413	23,944,320
Hawaii		3,668	3,668	2,347,520
Idaho	128	13,163	13,291	8,506,240
Illinois		6,770	6,770	4,332,800
Indiana	1,042	23,438	24,480	15,667,200
Iowa	330	52,861	53,191	34,042,240
Kansas		16,854	16,854	10,786,560
Kentucky	158	6,281	6,439	4,120,960
Louisiana		17,431	17,431	11,155,840
Maine	349	2,837	3,186	2,039,040
Maryland		13,959	13,959	8,933,760
Massachusetts		8,811	8,811	5,639,040
Michigan	397	33,781	34,178	21,873,920
Minnesota	441	13,344	13,785	8,822,400
Mississippi		31,304	31,304	20,034,560
Missouri	513	37,199	37,712	24,135,680
Montana	91	3,366	3,457	2,212,480
Nebraska	1,724	72,854	74,578	47,729,920
Nevada		652	652	417,280
New Hampshire	506	6,312	6,818	4,363,520
New Jersey		9,895	9,895	6,332,800
New Mexico		2,565	2,565	1,641,600
New York	819	39,248	40,067	25,642,880
North Carolina	627	50,701	51,328	32,849,920
North Dakota		23,049	23,049	14,751,360
Ohio	72	18,890	18,962	12,135,680
Oklahoma	1,152	27,353	28,505	18,243,200
Oregon	132	16,444	16,576	10,608,640
Pennsylvania	495	23,631	24,126	15,440,640
Puerto Rico		3,765	3,765	2,409,600
Rhode Island	65	2,087	2,152	1,377,280
South Carolina	316	27,435	27,751	17,760,640
South Dakota		8,286	8,286	5,303,040
Tennessee	726	14,519	15,245	9,756,800
Texas	406	68,309	68,715	43,977,600
Utah	311	3,406	3,717	2,378,880
Vermont		1,175	1,175	752,000
Virginia	913	17,527	18,440	11,801,600
Washington	1,763	16,120	17,883	11,445,120
West Virginia		24,681	24,681	15,795,840
Wisconsin		26,659	26,659	17,061,760
Wyoming	1,211	15,877	17,088	10,936,320
Total	17,454	993,339	1,010,793	646,907,520

RECONNAISSANCE SURVEYS

Alaska		31,915	31,915	20,425,600
Arkansas-Missouri		58,000	58,000	37,120,000
California		32,135	32,135	20,566,400
Hawaii	2,738		2,738	1,752,320
Kansas		39,960	39,960	25,574,400
Michigan		1,322	1,322	846,080
Minnesota		12,744	12,744	8,156,160
Montana	2,193	54,943	57,136	36,567,040
Nebraska		53,064	53,064	33,960,960
North Dakota		39,240	39,240	25,113,600
Ohio		41,420	41,420	26,508,800
Pennsylvania		41,405	41,405	26,499,200
South Dakota		41,400	41,400	26,496,000
Texas		152,855	152,855	97,827,200
Vermont		9,124	9,124	5,839,360
Washington		18,409	18,409	11,781,760
Wisconsin		14,425	14,425	9,232,000
Total	4,931	642,361	647,292	414,266,880

[1] Figures include some resurveys of certain areas.

SOIL SURVEY REPORTS[1] PUBLISHED DURING THE FISCAL YEAR 1939

Alabama:
Colbert County.
Dallas County.
Hale County.

Georgia:
Decatur County.

Kansas:
Allen County.

Michigan:
Mason County.
Saginaw County.

Mississippi:
Marion County.

Nebraska:
Brown County.
Gosper County.
Hayes County.
Holt County.
Wheeler County.

New York:
Monroe County.
Onondaga County.

North Carolina:
Carteret County.

Ohio:
Adams County.
Athens County.
Vinton County.

Oklahoma:
Alfalafa County.
Carter County.
Woodward County.

Pennsylvania:
Armstrong County.
Franklin County.

Rhode Island:
Kent and Washington Counties.

South Carolina:
Edgefield County.

Texas:
Bee County.
Hunt County.
Williamson County.

Utah:
Price area.

Washington:
Kitsap County.

Wyoming:
Sheridan County.

PRODUCTIVITY RATINGS OF SOIL TYPES IMPROVED

In cooperation with other research agencies, further progress has been made in developing a satisfactory system for the compilation of ratings of the productivity of soil types for adapted crops under physically defined systems of management. Special studies at the Iowa, California, and Illinois Agricultural Experiment Stations and elsewhere are being developed that will provide additional data necessary for making the ratings more precise.

SYSTEM OF SOIL CLASSIFICATION IMPROVED

Special emphasis was given to the development of effective and economical methods for mapping variations of slope, stoniness, and other characteristics within soil types. Soil maps made previously, with some of these soil features shown separately, have been very difficult of interpretation, since the relative significance of any variation in a single soil characteristic depends on the other soil characteristics. It has been found necessary to develop more precisely a system for including such factors within the definition of each soil type and for mapping any significant variations as phase designations within each particular soil type, defined individually, according to the other characteristics of the type.

[1] All detailed surveys.

SUGAR PLANT INVESTIGATIONS

E. W. BRANDES, *in charge*

RESEARCH PROGRAM BENEFITS SUGAR INDUSTRIES

Continued development and commercial introduction of adapted and disease-resistant sugarcane varieties and disease-resistant sugar beets are serving to rehabilitate and restore certain sugar-producing areas in the South and West from their previous marginal or submarginal positions. The dramatic upcurve in sugarcane yields from the all-time low of 1926 to the present position, where, on curtailed acreages, the annual sugar production equals that of the best years prior to the advent of the devastating diseases, affords evidence of the contribution being made by this research. The removal of the threat of failure of the sugar-beet crop in Western States because of curly top, through the continued improvement in resistance of beet varieties, is signalized by the rebuilt factory in the Yakima Valley of Washington, the erection of new factories in California, Utah, and Idaho, and the reentrance of the sugar beet into districts of California, Nevada, Idaho, Utah, New Mexico, and western Colorado. Agronomic investigations are finding proper crop-sequence practices for sugar beets, thus laying a ground work for rational soil-conservation measures in the major sugar-beet districts. For both sugarcane and sugar beet, a new idea in crop improvement has been crystallizing from the research experience of the last 20 years, leading to the use of both wild and cultivated species from various parts of the world in breeding experiments with the object of developing useful new types of hybridization. The method is distinct from the mere "resettlement" of plants and from improvement by using present cultivated forms as points of departure.

CHLOROTIC STREAK OF SUGARCANE CONFINED TO LOUISIANA

The presence of chlorotic streak in the mainland sugarcane area of the United States, suspected the previous year, was confirmed in 1938. In Australia this supposed virus disease of sugarcane may cause losses of up to 30 percent. The evidence points to rather recent introduction of the disease in the United States. No cases were found in Florida, Georgia, Alabama, or Mississippi, and in Louisiana the disease appears to be confined to districts east of the Atchafalaya River; but known distribution is based on a hurried reconnaissance survey.

MILD SUGARCANE MOSAIC STRAIN IN HAWAII EXPLAINS MODERATE INJURY

For some years it has been known that mosaic of sugarcane does not cause as severe damage in Hawaii as in other important sugarcane-growing countries. Tests of mosaic viruses from different sources, including Hawaii, explained this on the basis of an actual difference in the effect of the virus from Hawaii on varieties commonly grown there. The local strain produced fewer infections and milder symptoms than strains from other sources. While it is not concluded that the mild strain will cause similar mild reaction in all sugarcane varieties that may in future be grown in Hawaii, it seems important to continue vigilant measures in Hawaii to prevent the introduction of other, possibly more dangerous strains.

SORGO AND SUGARCANE-SORGO HYBRIDS

Four sugarcane-sorgo hybrids mentioned in the 1937 report have now been backcrossed with sugarcane in an effort to obtain early varieties suitable for milling before the beginning of the present milling season. One of the hybrids is high in sugar percentage and purity of juice and is being tested for cultural characteristics. Yields of the sugarcane-sorgo hybrids as a whole are not very promising, but a few exceptional examples warrant continuance of this line of breeding. In cooperation with the Bureau of Agricultural Chemistry and Engineering, a review is being conducted of the potentialities of sorgo itself as a source of sugar.

SUGAR-BEET SPACING STUDIES OFFER KEY IN MECHANIZATION PROBLEM

Varietal response has been found to have significant bearing on the fundamental questions involved in optimum space allotment to the individual beet. U. S. 22, a variety with strong growth tendency, produced, in Utah tests, an acre yield of roots greater by 5 tons with 14-inch than with 8-inch row spacing. Another variety, U. S. 24, produced 2.2 tons more roots with 8-inch than with 14-inch spacing. Recent studies in California have shown that when doubles (or triples) were left and the row interval was maintained at 10 to 12 inches, marketable tonnages were below those obtained from singling. If, however, doubles were left wherever possible in the hills, and the row interval was also doubled, the marketable tonnages did not differ significantly from those obtained in plots having only one beet in a place, normally spaced. The results of these tests have practical application in the problem of replacing the relatively slow and expensive job of hand thinning by machine operations.

PLANTING SUGAR BEETS ON BEDS REDUCES SEEDLING DISEASES

In experiments in cooperation with the Ohio Agricultural Experiment Station, improved stands have resulted from better surface drainage obtained by planting sugar beets in paired rows on ridges or beds, as is the practice in California. The land was fall-plowed and thrown up into ridges 40 inches apart by a lister. In the spring the ridges were formed by means of a suitable sled shaper into flat-topped planting beds, which, when the plots were ready for planting, alternated with furrows approximately 6 inches deep. By a properly arranged ridge and furrow system, conforming to land contours, and with discharge ditches to remove the excess water, greatly improved soil-moisture conditions were obtained. Similar drainage effects were also obtained by plowing the field to form narrow lands or beds, on which 8 to 12 rows of beets were planted, the back furrows left by this type of plowing serving as shallow surface drainage ditches. The striking results in the experimental plantings have aroused great interest because of the seriousness of seedling diseases in many districts. In the bed plantings, improved surface drainage operates to check the activity of soil fungi, which in the main are favored by an excess of soil moisture.

NEW CURLY-TOP-RESISTANT SUGAR-BEET VARIETY RELEASED

The Bureau releases of varieties of sugar beet resistant to curly top, U. S. 1, U. S. 34, U. S. 33, U. S. 12, U. S. 15, and others, have been

used to the limit in the curly-top-affected areas in which they are suited and practically constitute the bulk of varieties grown in the Western States. Evaluation tests conducted in the various districts either by the Division or by interested beet-sugar companies have always preceded any introduction and furnished the factual basis for judging the utility of a proposed release. The 1938 tests in Idaho brought to light the outstanding performance of a variety now designated U. S. 22. Under moderate curly top exposure of one test, where the acre yield of a European brand was 9.8 tons, U. S. 22 yielded 29.6 tons. In this same test U. S. 33 showed an acre yield of 24.0 tons and U. S. 12 of 25.5 tons. In another test in the same general area, under more severe curly top exposure, the European brand had an acre yield of 3.4 tons; U. S. 33, 20.7 tons; and U. S. 22, 31.9 tons.

HYBRID VIGOR UTILIZED IN NEW LEAF-SPOT-RESISTANT SUGAR-BEET VARIETY

The leaf-spot-resistant sugar beet variety U. S. 217, released in 1938, has demonstrated a high degree of resistance and under exposure to the disease has shown decisively better performance than the European brands with which it has been compared. Where leaf spot was not a factor the variety has been exceeded in root yield, and hence in sugar per acre, by certain improved tonnage types. A new leaf-spot-resistant release, U. S. 200×215, produces greater tonnage than U. S. 217, with practically equivalent sucrose percentage. To produce this variety, two inbred strains, which in themselves, regardless of leaf-spot resistance, approximate European brands in performance, were intercrossed in order to take advantage of first-generation hybrid vigor. Tests in 1938 showed the resistant variety exceeded the nonresistant check, taken as representative of European brands, by 333 pounds of sugar to the acre. The variety has as yet been produced only on a limited scale, something over 200,000 pounds of seed being available for 1939 commercial plantings.

TOBACCO AND PLANT NUTRITION

W. W. Garner, *in charge*

INDUCTION OF POLYPLOIDY IN NICOTIANA SPECIES AND HYBRIDS BY TREATMENT WITH COLCHICINE

By treating the meristem with 0.4-percent colchicine, or the seed with 0.2-, 0.4-, and 0.8-percent colchicine, for 7, 10, and 14 days, the chromosome numbers of the following species and species hybrids have been doubled: *Nicotiana tabacum*, *N. rustica*, *N. glauca*, F_1 *N. tabacum* × *glauca*, F_1 *N. tabacum* × *sylvestris*, F_1 *N. glutinosa* × *glauca*, and some heteroploid segregants from the cross *N. rustica* × *tabacum*. The sterile hybrids were made fertile by the doubling, and these induced allotetraploids were large, vigorous plants The autotetraploids, on the other hand, were more sterile and less vigorous than their diploid parents. All the tetraploids had larger cells, thicker leaves, and larger and more widely spaced stomates, and usually broader flowers than the diploids. Pollen and seed size was approximately doubled in the tetraploid of *N. rustica*. This method of artifically inducing chromosome doubling makes it possible to produce

fertile interspecific hybrids at will, and thus to establish a foundation for further breeding work where it is desirable to transfer a hereditary characteristic from one species to another.

WILD SPECIES OF NICOTIANA AS A SOURCE OF DISEASE RESISTANCE

During the last 4 years collections of tobacco seed have been tested for resistance to the major diseases. Adequate resistance to such troubles as black root rot, mosaic, and root knot has been discovered, but no high degree of resistance to wildfire or blue mold has been found. Study of native wild species of *Nicotiana*, however, has shown that a number of these are apparently immune to either wildfire or blue mold. Attempts have been made in the past to use wildfire resistance from this source, but the species employed was *N. alata* var. *grandiflora*, which has only 9 pairs of chromosomes, as compared with 24 in *N. tabacum*. The hybrids from this cross were sterile. It has now been found that *N. repanda* and *N. nesophila* are also immune to wildfire, and both possess 24 pairs of chromosomes. As a result it is believed that the difficulty of obtaining fertile hybrids will be greatly reduced.

METHODS DEVELOPED FOR CONTROL OF BLUE MOLD OF TOBACCO

The copper oxide-cottonseed oil spray for the control of blue mold of tobacco was used extensively by growers for the first time in 1938. Repeated tests have shown that the major part of the protection derived from this spray is due to the oil; therefore, the fungicidal value of oils against blue mold has been carefully studied. It has been found that the petroleum and terpene oils are inert fungicidally, and that this is also true of many vegetable and animal oils. A few, including cottonseed, tung, soybean, linseed, and oiticica oils, have marked fungicidal value. This quality appears to be associated with the presence of large amounts of the glycerides of linoleic, elaeostearic, or licanic acids, all of which are closely related chemically.

As the result of extensive cooperative tests in Georgia, South Carolina, North Carolina, and Maryland, a gas treatment with paradichlorbenzene has been developed that is simpler to use than the benzol gas treatment. This latter method is effective, but it has not been used by the growers, who consider it too expensive and cumbersome. In searching for ways to reduce the cost and labor, it has been found that by using bed covers of varying tightness the amount of paradichlorbenzene required to control blue mold may vary from one-fourteenth to one-half of an ounce per square yard, and that less than half as much material is required under a wet cloth cover as under a dry cover. Also, in place of nightly treatments with small doses of paradichlorbenzene, effective control has been obtained with heavier treatments twice a week; consequently, a single muslin cover, one of the major items of expense, can be used for two sets of beds. These developments point the way to reduction in the labor and expense of gas treatment.

CONTROL OF BLACK SHANK IN FLUE-CURED TOBACCO AREAS

The disease known as black shank of tobacco and other plants is well established and constantly spreading in the flue-cured tobacco section of western North Carolina, and in 1937 and 1938 it occurred

in the most intensive producing area of eastern North Carolina. Fortunately, control studies in cooperation with the State are already giving definite results. Breeding work has produced resistant flue-cured types that in 1938 tests appeared to possess excellent quality, and rotation studies have shown that in western North Carolina 4- to 6-year rotations consistently give excellent control of black shank. Results have been equally satisfactory with all the common field crops except potatoes. The results also indicate that once black shank has been brought under control, planting tobacco land to other crops for 2 years will probably be adequate.

FLUE-CURING TOBACCO WITH OIL, ELECTRICITY, AND COAL

The growing scarcity of wood as a fuel for flue-curing tobacco is rapidly becoming a serious problem. Coal and oil as substitutes have been tried and found to give satisfactory results. Burners of the wick type have given good results with oil and when kept clean have not imparted any objectionable odor to the cured leaf. The use of coal has certain limitations, since the furnace must be constructed of firebrick, and electricity should be available to permit the use of a thermostatically controlled stoker. The cost of curing an average barn with wood is approximately $7.50 and involves the consumption of 1½ cords, valued at $5 a cord. The quantity of fuel oil required for each curing has varied from 75 to 100 gallons, costing about $6.50 to $8.50. The cost of oil, therefore, is not prohibitive. The cost of curing with coal is about half that of curing with oil, with an average consumption of about 1,100 pounds of coal to the barn, at a cost of about $7.50 a ton. The average cost of electricity for operation of the coal stoker was 30 cents a barn. When electricity was tried as a source of heat in an experimental barn the cost was found to be prohibitive. The use of either oil or coal aids greatly in maintaining uniform temperatures in the barn.

DISTINCTIVE EFFECTS OF COPPER DEFICIENCY ON GROWTH OF TOBACCO

The effects of insufficient copper concentration on the growth of the tobacco plant have not been observed under field conditions, though such effects on other plants grown on certain soils high in organic matter have been reported. The characteristic effects of a deficient supply of copper on tobacco when grown under controlled conditions in the greenhouse are as follows: The upper leaves are unable to maintain their turgor and consequently wilt badly. Such plants are permanently wilted and do not recover at night or during cloudy periods as does a plant that has wilted during a hot day. The reduction in growth will be in proportion to the degree of shortage of the element and the stage of growth at which the element becomes the limiting factor. It was observed that the amount of seed formed was reduced when copper was the limiting factor during the flowering stage and that the seed stalk did not stand erect as did plants to which traces of copper were supplied. The amount of copper necessary to correct effects of deficiency in nutrient solutions varied from one-sixteenth to one-eighth part per million. Amounts much in excess of these quantities produced a decided stunting of plants.

WESTERN IRRIGATION AGRICULTURE

C. S. Scofield, *in charge*

PLANTS REQUIRE CERTAIN MINIMUM CONCENTRATIONS OF BORON

The investigations of the reactions of crop plants to boron in the soil solution have brought out the fact that plants require certain minimum concentrations of boron in order to make normal growth, as well as the fact that boron concentrations above optimum are injurious to plant growth. It appears that there are extensive areas in the United States in which the quantity of available boron in the soil solution is so low that successive crops reduce the supply of this element below the level of plant requirements, so that applications of boron are necessary to produce normal crops.

SALT CONCENTRATION REMOVED BY COPIOUS IRRIGATION

A land reclamation experiment on the Yakima irrigation project in southern Washington was begun in the spring of 1937 and completed in 1938. The first year's work consisted in a successful attempt to remove the excessive salt concentrations in the soil and in the soil solution by copious irrigation. In its original state the land was completely unproductive. At the end of the treatment period sugar beets were planted on the tract. They returned a mean yield of 24 tons of beets to the acre. Records were kept of the groundwater elevations and the salinity trends of the soil solution.

IMPROVED CROP ROTATIONS BENEFIT IRRIGATED POTATOES

One of the more important cash crops produced under irrigation in western Nebraska is potatoes. Among the problems involved are those of maintaining crop yields by proper agronomic practices as well as minimizing the injuries from plant diseases and insect pests. Plant diseases often have been found to be closely associated with cropping practices. Recent investigations afford evidence that improved systems of crop rotation greatly reduce the injuries caused by certain pathological organisms in the soil. Recently progress has been made in developing strains of potatoes, well-adapted to the section, that promise to be more resistant to certain of the more-common destructive pahtogenic organisms.

ARLINGTON EXPERIMENT FARM

E. C. Butterfield, *in charge*

Although there have been no major changes in the character or volume of either the research or maintenance work at the Arlington Experiment Farm, Arlington, Va., orderly progress has been made in both. The facilities and service afforded to reasearch activities have been gradually improved. The greenhouses, buildings, roads, and various utilities have been kept in repair, considerable grading and soil-improvement work has been accomplished, the tile drainage system has been extended, and several new and improved pieces of equipment have been acquired.

EXPERIMENTAL GREENHOUSES

J. W. Byrnes, *in charge*

Two new carnation seedlings were named Wealth and Moonbeam, and rooted cuttings were disseminated to 21 growers for trial. There is still a heavy demand for the previously introduced carnation varieties Carlotta, Rigoletto, Mavourneen, Blaze, Glory, and Burgundy, of which a number of rooted cuttings were disseminated again this year. These six varieties are displacing older varieties in the trade. The following chrysanthemums were named in the fall of 1938 and disseminated to growers in the spring of 1939: Japanese: Des Moines, Football Favorite, Saxon Beauty. Pompons: Gipsy, Autumn Dusk, Mauve Lady, Pot of Gold, Madam, Amber, Bonfire, Summer's End, Persian Accent, Autumn Revery. Some newer croton varieties and hybrid amaryllis were also released.

The thirty-seventh annual chrysanthemum show was held in November and the twenty-sixth annual aramyllis show in March and April. The combined attendance was about 65,000.

PUBLICATIONS, INFORMATION, EXTENSION

During the year 148 publications (136 new and 12 revised) contributed by the Bureau were issued in the Department series. These comprised 43 papers in the Journal of Agricultural Research, 22 Technical Bulletins, and 83 other items, semitechnical or popular. In addition, there appeared in outside scientific, agricultural, and commercial publications about 535 articles written by members of the Bureau's staff on various subjects related to its field of activity. A list showing the new official publications and most of the outside contributions is appended.

The Bureau continued to cooperate with the Press Service and the Radio Service of the Office of Information in preparing and furnishing informational material.

Through three extension specialists, cooperatively maintained, dealing respectively with plant-disease control, horticulture, and agronomy, cooperation was continued with the Department's Extension Service and the State agricultural extension services in making available to farmers the practical benefits of research.

LIST OF PUBLICATIONS

OFFICE OF CHIEF

Report of the Chief of the Bureau of Plant Industry for the fiscal year ended June 30, 1938. By E. C. Auchter.

The interrelation of soils and plant, animal and human nutrition. By E. C. Auchter. Science 89: 421–427.

Contributions to rose culture by the Bureau of Plant Industry, U. S. Dept. of Agriculture. By E. C. Auchter. Florists' Exch. 92 (24): 13.

CEREAL CROPS AND DISEASES

Small grain investigations. By I. M. Atkins. Tex. Agr. Expt. Sta. Ann. Rpt. 50: 207–212. (In cooperation.)

Mutants and linkage studies in *Triticum monococcum* and *T. aegilopoides*. By L. Smith. Mo. Agr. Expt. Sta. Res. Bul. 298. (In cooperation.)

Amphidiploids in the Triticinae induced by colchicine. By E. R. Sears. Jour. Hered. 30: 38–43. (In cooperation with Mo. Agr. Expt. Sta.)

Observations on the immediate effects of colchicine. By J. G. O'Mara. Jour. Hered. 30: 35–37. (In cooperation with Mo. Agr. Expt. Sta.)

Investigations in plot technic with small grains. By H. H. Love and W. T. Craig. N. Y. (Cornell) Agr. Expt. Sta. Mem. 214. (In cooperation.)

Breeding small grains for resistance to rust. By E. S. McFadden and P. C. Mangelsdorf. Tex. Agr. Expt. Sta. Ann. Rpt. 50: 84–86. (In cooperation.)

The Minnesota seed-grain treater. By M. B. Moore. U. S. Dept. Agr. Misc. Pub. 330. (In cooperation with Ext. Serv.)

Two mastigosporium leaf spots on Gramineae. By R. Sprague. Jour. Agr. Res. 57: 287–299. (In cooperation with Oreg. and Wash. Agr. Expt. Stas.)

Soil-borne cereal diseases in coastal Oregon. By R. Sprague. Northwest Sci. 12 : 74–80.

Reaction of wheat, barley, and rye varieties to stripe rust in the Pacific Northwest. By W. M. Bever. U. S. Dept. Agr. Cir. 501. (In cooperation with Idaho Agr. Expt. Sta.)

Kansas mycological notes, 1936. By C. O. Johnston, C. L. Lefebvre, and E. D. Hansing. Kans. Acad. Sci. Trans. 40 : 69–74. (In cooperation with Kans. State Col.)

Purification of Nicotina virus 6 protein. By H. H. Thornberry and H. H. McKinney. Phytopathology 29 : 250–260. (In cooperation with Bur. Chem. and Soils.)

BARLEY

Barley production in Kansas. By A. F. Swanson and H. H. Laude. Kans. Agr. Expt. Sta. Bul. 280. (In cooperation.)

Barley production in Oregon. By D. D. Hill, D. E. Stephens, D. E. Richards, R. E. Hutchison, and J. F. Martin. Oreg. Agr. Expt. Sta. Bul. 355. (In cooperation.)

The effect of natural selection in a mixture of barley varieties. By H. V. Harlan and M. L. Martini. Jour. Agr. Res. 57 : 189–199.

Chevron, a barley variety resistant to stem rust and other diseases. By R. G. Shands. Phytopathology 29 : 209–211. (In cooperation with Univ. Wis.)

The status of *Septoria graminum*. By R. Sprague. Mycologia 30 : 672–678. (In cooperation with Oreg. and Wash. Agr. Expt. Stas.)

A survey of malting quality of barley varieties grown in the United States. By J. G. Dickson. Modern Brewer 20 (4) : 36, 38, 40, 42, 44, 86. (In cooperation with Wis. Agr. Expt. Sta.) Also in Brewery Age 6 (10) : 61–66.

CORN

Maize—our heritage from the Indian. By J. H. Kempton. Smithsn. Inst. Ann. Rpt. 1936/37 : 385–408.

Seed corn. By M. T. Jenkins. U. S. Dept. Agr. Farmers' Bul. 1822.

Effect of the *Dt* gene on the mutability of the *a*, allele in maize. By M. M. Rhoades. Genetics 23 : 377–397.

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REPORT OF THE CHIEF OF THE OFFICE OF PLANT AND OPERATIONS, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF PLANT AND OPERATIONS,
Washington, D. C., October 30, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the work of the Office of Plant and Operations for the fiscal year ended June 30, 1939.

Sincerely yours,

ARTHUR B. THATCHER, *Chief.*

The first annual report of the Office of Plant and Operations includes the activities of the former Division of Operation, the Office of the General Superintendent of the Beltsville Research Center, Beltsville, Md., and the Technical Advisory Board.

By order of the Secretary, dated February 27, 1939, the former Division of Operation became known as the Office of Plant and Operations, and in addition to the transfer of the management phase of the Beltsville Research Center and the Technical Advisory Board, the functions and responsibilities of the former Division of Operation were greatly increased under the new Office. From March 1, 1939, up to the close of the fiscal year, the major efforts of this Office have been directed toward the initiation of a program in accordance with its functions and a reorganization and revitalizing of existing activities for purposes of greater and more efficient service. It is believed that some progress has been made in these 4 months of existence, the details of which will be more clearly given further on in this report.

The report is divided into seven major divisions which represent the organizational responsibility of this Office.

ADMINISTRATIVE SERVICES DIVISION

The Administrative Services Division is responsible for the fiscal and personnel control for the Office of the Secretary, including the Offices of Budget and Finance, Personnel, Plant and Operations, Land Use Coordination, Marketing and Regulatory Work, also the maintenance of pertinent records. It approves and records requisitions for supplies and equipment and performs other general service functions. Since the transfer of the responsibility for the supervision of the Office of the General Superintendent, Beltsville Research Center, to the Office

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of Plant and Operations, this Division has exercised an administrative responsibility in connection with personnel actions and the budget of the center.

The appropriations and expenditures for the Office of the Secretary during the past 3 fiscal years are shown in table 1.

TABLE 1.—*Appropriations and expenditures, Office of the Secretary, fiscal years 1937, 1938, and 1939*

Item	1937	1938	1939
Appropriations	$616,019	$591,450	$870,825
Expenditures	596,216	580,225	844,719

BELTSVILLE RESEARCH CENTER

On March 1, 1939, the responsibility for departmental service and management functions of the Beltsville Research Center were placed in the Office of Plant and Operations. The Beltsville Research Center covers an area of 12,461 acres. There are located on the property facilities for indoor and outdoor experiments by a staff of scientific workers representing eight bureaus of the Department. The experiments cover a wide range of research in fundamental problems of agriculture.

The Office of the General Superintendent, through its centralized organization, develops and maintains the facilities required by the research staffs. To maintain these activities, the Office of the General Superintendent had on its rolls as of June 30, 1939, 146 regular employees. The problems of administration have greatly increased due to the inauguration of a combined Work Projects Administration and Public Works Administration construction program designed to augment the research and service facilities of the center.

Indicative of the increased burden is the fact that this program necessitated the handling of 23,375 personnel transactions, while, at the same time, a total of such transactions for the permanent force totaled 7,144 which in itself is an increase of 1,137 in the number of permanent roll transactions over the preceding fiscal year. The establishment of a cost accounting system for the construction program, necessitated approximately 37,500 postings and the issuance of 61 monthly project cost reports. Four hundred and eighty-five contracts were prepared and administered in addition to a total of 329 contracts for the regular work, an increase of 40 contracts for regular work over those handled during the preceding year. A total of 5,089 purchase orders were issued in connection with the construction program. In addition, a total of 5,481 purchase orders were issued for the regular work of the center, an increase of 1,126 purchase orders for regular work in excess of the number issued in the fiscal year 1938.

The performance of services, on a reimbursable basis, for the various bureaus located at the center was valued at $508,970, an increase of 20 percent for this year. Nonreimbursable work performed totaled $52,390, an increase of 34 percent.

The Administration Building, which is scheduled for completion during the fiscal year 1940, will make it possible for the administra-

tive staff to be quartered in a single building rather than scattered throughout the center as has been the case this year.

During the year the center performed services for 8 bureaus. Farm operations on 2,500 acres of land included plowing, seeding, cultivation, harvesting, and storing of crops; and the manufacture of 2,344 tons of animal feeds. These operations required a total of 18,083 man-days. The center constructed 27 buildings, ranging in cost from $250 to $25,000; laid 2 miles of 6-inch water mains, 3 miles of small branch mains, 1 mile of terra cotta sewer pipe; and made building alterations and repairs to the value of $65,000.

The center operated a central garage for the repair and maintenance of trucks and tractors; maintained three large steam-boiler plants and a blacksmith shop; operated a granary which furnished feed valued at $67,150, also a central sewage-disposal plant which handled 80,171,000 gallons, an increase over the previous year of 38 percent with an increase in operating cost of only 8 percent. A 2-way ultra short-wave radio system is used to contact the foremen, superintendent, engineers, and guards. Janitor and watchman service is provided as are general delivery service, fire protection, maintenance of roads, and procurement service. A total of 2,354 jobs were completed for which service requests were received. To perform this work an average of 312.8 men were employed per month.

The efficiency of service operations has been greatly increased through the completion of additional shop and service facilities under the P. W. A.-W. P. A. construction program, and during the next fiscal year, as other facilities are put into operation, additional efficiency may be expected.

The Public Works Administration and the Work Projects Administration made available a total of $4,601,871 (P. W. A., $3,492,671 and W. P. A., $1,109,200), for the construction of additional research and service facilities at the center, including $100,000 for W. P. A. administrative expenses. This program includes additional facilities for the Research Center and the following bureaus: Animal Industry, Food and Drug, Agricultural Chemistry and Engineering, Biological Survey, Dairy Industry, Forest Service, Plant Industry, and Soil Conservation Service.

The facilities authorized under this program include laboratories for the Bureau of Agricultural Chemistry and Engineering, $700,000; Food and Drug Administration, $715,000; Administration Building and Home Economics Laboratory, $650,000; Bureau of Plant Industry cold-storage laboratory, $300,000, and other smaller laboratory structures. It also includes the service building for the center, $245,000, and the central heating plant for the horticultural area, $160,000, as well as greenhouses, barns, silos, residences, water supply, sewage disposal, fencing, roads, grading, drainage, etc.

A total of $2,215,079 (P. W. A., $1,677,190 and W. P. A., $637,889) was obligated, leaving a balance of $2,286,792 (P. W. A., $1,815,481 and W. P. A., $471,311), to be expended during the fiscal year 1940. There were employed on this program an average of 1,009 workers per month over a 10½-month period. At the close of the year the program was approximately 50 percent complete.

Three C. C. C. camps have been available which have contributed 93,496 man-days of labor in the maintenance and development of the

center properties, including such work as fencing, roads, pipe and tile lines, septic tanks, clearing, landscaping, walks, operation of a nursery, a sawmill, and other similar types of work. A total of $125,800 was provided for the operation of the program of these camps.

The Beltsville Research Center is rapidly becoming an agricultural show place. Thousands of visitors from all parts of the country came to the center, many of whom were scientists, interested in a particular phase of the work. Insofar as present facilities and personnel have permitted, efforts have been made to enable visitors to see those portions of the center and those processes in which they are most interested.

COMMUNICATIONS DIVISION

The Communications Division is responsible for handling all matters pertaining to the operation of the telephone, telegraph, and mail communications systems; arranging for the transfer of records of permanent or historical value to the archives, also the disposition of useless records; and the development of a uniform system of filing organization and operation for the Department.

MAIL AND FILES

The Mail and Files Section opens, reads, records, indexes, and files correspondence for the Secretary of Agriculture, Under Secretary, the Office of Plant and Operations, and reviews all letters and documents prepared for the signature of the Secretary and members of his staff for typographical errors, form, and proper bureau approval; it files correspondence for the Offices of Budget and Finance, Personnel, Land Use Coordination, and Marketing and Regulatory Work. This section maintains a messenger pool serving the various branches of the Secretary's Office and a messenger truck service for use by the various bureaus and offices of the Department. In order to expedite the business of the Department and reduce administration costs, it is proposed to make a survey and establish truck trade routes for the delivery of communications and documents to outlying offices of the Department.

There were 236,673 items of incoming mail and telegrams received by the Secretary in 1937, 408,408 in 1938, and 468,973 in 1939.

Since April 1939, this section has prepared correspondence relating to the disposition of official papers of the Department, in accordance with the National Archives Act, and transmitted all documents submitted to the Federal Register Division of the National Archives in accordance with the Federal Register Act. The chief of this section is custodian of the official seal of the Department of Agriculture and is responsible for its use in the verification of official papers.

This section supervises the Department post office. During the fiscal year 1939, the post office affixed postage totaling $10,970.50 to parcel post, air mail, foreign mail, special delivery, and registered mail. The value of registered mail received and dispatched during the year was approximately $250,000. The number of pieces handled in the last 3 years is shown in table 2.

TABLE 2.—*Mail handled by the Department post office, 1937–39*

Item	1937	1938	1939
	Number	*Number*	*Number*
Pieces of incoming mail	10, 529, 007	9, 313, 955	9, 058, 897
Pieces of outgoing mail	4, 977, 890	8, 123, 753	11, 970, 677
Interbureau communications	557, 220	451, 990	454, 994

The Department post office operates the pneumatic-tube system. The central station is located in the post office and with 19 stations throughout the Administration and South Buildings serves 21 bureaus of the Department. Tube carriers pass through the central station at the rate of 3 per minute for 8 hours each business day, totaling 1,500 carriers per day and approximately 450,000 carriers every year. In addition to the regular use for mail, the dispatch of approximately 155,000 telegrams during the past year was expedited by the use of the tube system.

TELEGRAPH AND TELEPHONE

The switchboard, formerly operated by the Farm Security Administration, was discontinued and its system tied into the Department's automatic system. Tables 3 to 5 give telephone and telegraph data for the last 3 years.

TABLE 3.—*Distribution of telephone calls made in the Department of Agriculture, 1937–39*

Type of call	1937	1938	1939
Automatic switchboard:	*Number*	*Number*	*Number*
Branch to branch		6, 164, 700	8, 287, 084
Outgoing trunk lines	708, 314	765, 463	850, 916
Outgoing Government trunk lines	252, 528	259, 379	323, 912
Outgoing tie lines			[1] 551, 104
Total	960, 842	7, 189, 542	10, 013, 016
Manual switchboard:			
Incoming trunk lines	1, 474, 864	1, 484, 829	1, 650, 777
Incoming Government trunk lines	363, 222	380, 518	382, 588
Incoming tie lines	984, 320	1, 216, 235	910, 200
Outgoing long distance	16, 669	19, 950	24, 839
Incoming long distance	13, 186	14, 223	16, 008
Interzone calls to nearby points			2, 131
Total	2, 852, 261	3, 115, 755	2, 986, 543

[1] During 1939 registers were installed which count the number of tie-line calls.

TABLE 4.—*Telephones in use and telegraph messages handled, fiscal years 1932–39*

Fiscal year	Main stations	Extension stations	Total	Telegraph messages (incoming and outgoing)
	Number	*Number*	*Number*	*Number*
1932	918	941	1, 859	62, 462
1933	979	938	1, 917	60, 257
1934	1, 424	1, 258	2, 682	166, 158
1935	1, 891	1, 535	3, 426	213, 096
1936	2, 082	1, 562	3, 644	193, 189
1937	2, 106	1, 579	3, 685	154, 964
1938	2, 405	2, 118	4, 523	222, 388
1939	3, 217	2, 509	5, 726	206, 300

TABLE 5.—*Telephone and telegraph cost data, 1938–39*

Item	1938		1939	
	Audited	Cost	Audited	Cost
	Number	*Dollars*	*Number*	*Dollars*
Rental of telephone equipment		93,862.54		127,058.02
Long-distance calls		88,351.60		127,973.05
Telegrams	253,158	118,949.16	254,075	105,565.86

All telephone rental and service vouchers for the Department except the Weather Bureau and all telegraph vouchers with the exception of the Weather Bureau, Soil Conservation Service, and the Farm Security Administration were audited by this section. Pertinent records were maintained to support all certifications included in these vouchers. By careful scrutiny and proper routing of outgoing telegrams and by the use of the facilities of Army and Navy radio systems, about $36,700 was saved in the cost of telegraph messages during the year.

PROCEDURE

The lack of uniformity among the bureaus in the method of filing records has emphasized the need in the Department of a uniform system of filing operations. Such a system would expedite the handling of official papers, simplify the recording of documents, and make them more readily available when needed. It would eliminate unnecessary duplicate files with resultant savings in the amounts expended for equipment, file supplies, space, and personal services. This system would also be advantageous in transferring personnel experienced in filing procedure from one bureau to another as vacancies occur and at the same time afford greater opportunity for promotion of employees in this field. A limited staff of technicians are attacking this general problem and some progress has been made during the 4 months of their activity.

MOTOR TRANSPORT DIVISION

This Division controls the motortruck pool which comprises a fleet of 43 vehicles available for use by the various bureaus and offices of the Department upon call. Seven vehicles included in the above were acquired from the Farm Security Administration December 1, 1938. A repair garage is maintained by the Division for the purpose of servicing the trucks of the motortruck pool, passenger cars which are operated within the District of Columbia and any field passenger cars or trucks temporarily in Washington.

The Motor Transport Division operates without a working fund and depends upon reimbursement from the various bureaus for all work accomplished. Certain items, however, are of such character that they cannot be charged to the various bureaus, as the hauling of mail, maintenance of passenger cars assigned to the Office of the Secretary, the cost of which is borne by the miscellaneous expense appropriation of the Office of the Secretary. The total cost of operating the Motor Transport Division for the year was $48,944.47, of

which $39,920.40 was obtained by reimbursement from the bureaus, leaving $9,024.07 as the amount charged to the miscellaneous expense appropriation, Office of the Secretary.

PROPERTY RECORDS AND STATISTICS DIVISION

Steps were taken to effect a reorganization of the existing property section and to add the function of recording real property owned by the Department; also to provide for statistical work required by the Office of Plant and Operations. The system of property accountability prescribed by the General Accounting Office and outlined in Budget and Finance Memorandum No. 103, was installed. A small surplus-property pool has been continued in operation to cover any emergency situations requiring the temporary utilization of office furniture. Due to the work involved in changing the system of property accountability with a limited personnel, only 10 local offices were inventoried and the inventories checked and necessary adjustments made to record the actual location of property. As of June 30, 1937, the cost of real property owned by the Department was $455,000,000 and the estimated fair market value of this property was $643,000,000. No revised estimates have been made.

REAL ESTATE DIVISION

The Real Estate Division is responsible for housing the operating units of the Department both in the District of Columbia and in the field. This includes: Initiation of a long-range program of planning the most efficient housing of Departmental activities; active prosecution of approved housing projects in connection therewith; study of possible consolidation of the housing of operating units with the view of securing greater economy and efficiency of operation; space control and assignments, construction, repairs, property management and maintenance, control of parking areas, leases, and related matters; relations with the Federal Works Agency and Post Office Department as they pertain to space. It has furnished engineering services in connection with air conditioning, electrical appliances, laboratory installations, the utilization of existing facilities and the development of new installations.

Because of the difficulty of obtaining additional space in Washington and the need for space for new activities and for relocation of personnel due to reorganization, a considerable amount of time was devoted to space assignments among the various agencies in Washington. In cooperation with these agencies, room-by-room surveys were made. In numerous cases, with the experience gained from observation of efficient working units and with the help of template lay-outs of the equipment on floor plans drawn to scale, it was possible to suggest a rearrangement of personnel and equipment which resulted in better working conditions along with a substantial saving of space. In a number of instances, space-consuming equipment found to be not in active use was transferred to places where it would serve a useful purpose. The more efficient utilization of space has made it possible for the Department to accommodate the increase in personnel in Washington and at the same time release approximately 54,000 square feet of space.

Outside of Washington, the expansion of activities of the Department was so much greater than could be accommodated in the new space in Federal buildings assigned by the Federal Works Agency and the Post Office Department, that the space in rented quarters increased.

Table 5 indicates the space occupied by the various bureaus and offices of the Department as of June 30, 1939, and the rental obligations for leased quarters as of that date.

TABLE 5.—*Space occupied by Department of Agriculture and rental obligations, 1939*

Organization	Federal buildings		Rented buildings			
	In District of Columbia	Outside District of Columbia [1]	In District of Columbia		Outside District of Columbia	
			Area	Rental	Area	Rental
	Square feet	*Square feet*	*Square feet*	*Dollars*	*Square feet*	*Dollars*
Agricultural Adjustment Administration	195, 849	27, 755	5, 373	7, 200	373, 398	201, 641
Bureau of Agricultural Economics	208, 683	183, 851	18, 759	21, 779	250, 969	118, 826
Bureau of Agricultural Engineering	19, 065	8, 510	4, 896	6, 364	16, 112	3, 543
Bureau of Animal Industry	53, 354	95, 814			91, 272	42, 472
Bureau of Biological Survey	42, 198	57, 685	2, 523	3, 027	37, 661	13, 439
Bureau of Chemistry and Soils	64, 310	1, 381	65, 633	14, 800	14, 705	6, 009
Commodity Exchange Administration	13, 268	439			23, 647	28, 831
Bureau of Dairy Industry	40, 007				320	216
Bureau of Entomology and Plant Quarantine	80, 635	160, 235			772, 328	180, 086
Office of Experiment Stations	15, 918					
Extension Service	77, 030	325, 731			31, 523	5, 575
Farm Security Administration	24, 212	160, 387	109, 604	101, 940	1, 010, 212	571, 667
Federal Crop Insurance Corporation	5, 149		8, 000	7, 500	52, 407	49, 257
Federal Surplus Commodities Corporation	67, 671	5, 000				
Food and Drug Administration	70, 520	109, 673			5, 361	2, 760
Forest Service	70, 515	582, 594	63, 100	57, 664	1, 297, 661	446. 601
Bureau of Home Economics	42, 428		5, 000	1		
Office of Information	45, 451	728				
Library	58, 769					
Bureau of Plant Industry	257, 179	14, 521			57, 752	14, 013
Bureau of Public Roads	16, 335	102, 929	79, 192	78, 952	111, 216	49, 280
Office of the Secretary	240, 319				960	1, 248
Soil Conservation Service	29, 608	52, 021	112, 700	155, 516	2, 772, 960	724, 271
Office of the Solicitor	47, 740	8, 667	1, 232	3, 225	6, 852	6, 759
Weather Bureau	36, 061	199, 678	9, 138	9, 070	70, 454	48, 688
Total	1, 822, 274	2, 097, 599	485, 150	467, 038	6, 997, 770	2, 515, 182

[1] Exclusive of buildings owned by the Department of Agriculture.

A summary of total space occupied by the Department of Agriculture for the years 1935–39 is shown in table 6.

TABLE 6.—*Space occupied by Department of Agriculture and rental obligations, 1935–39*

Year ended June 30—	Federal buidings		Rented buildings			
	In District of Columbia	Outside District of Columbia	In District of Columbia		Outside District of Columbia	
	Square feet	*Square feet*	*Square feet*	*Dollars*	*Square feet*	*Dollars*
1935	1, 447, 180	879, 020	168, 690	124, 257	2, 606, 937	846, 662
1936	1, 618, 723	1, 382, 897	311, 771	262, 612	4, 332, 792	1, 217, 523
1937	1, 725, 295	1, 685, 131	575, 021	514, 134	5, 970, 073	1, 940, 486
1938	1, 833, 287	1, 806, 212	528, 459	484, 518	6, 267, 690	2, 021, 439
1939	1, 822, 274	2, 097, 599	485, 150	467, 038	6, 997, 770	2, 515, 182

Under memoranda of the Secretary, dated April 16 and May 8, 1939, responsibility for all actions pertaining to bid and lease cases for office, storage, laboratory, and related space, also land for experimental purposes and other uses, was vested in the Office of Plant and Operations. This centralization of authority has effected a considerable savings in time required to process this type of action through the Office of the Secretary.

TECHNICAL ADVISORY BOARD

The Technical Advisory Board, which was appointed June 8, 1938, and transferred to the Office of Plant and Operations on March 1, 1939, has responsibility for development, by collaborative methods with the operating bureaus, of departmental standards for equipment, including automotive and other heavy equipment, its operation and maintenance, also aerial, photographic, and other optical equipment, and the study of such other related matters as may be determined from time to time. It has actively cooperated with the Chief, Division of Purchase, Sales, and Traffic and responsible officials of the several bureaus in the solution of problems incident to the procurement of equipment and with the respective Department and bureau offices in the determination of the policies to be adopted in the selection, operation, maintenance and repair of all types of equipment. The Division of Purchase, Sales, and Traffic is required to refer to the Board all requests for procurement of items of equipment which do not conform to standard specifications as promulgated by the Board, and any requests for equipment which, because of their general use, may require a promulgation of criteria and standard specifications in the interest of departmental efficiency and economy.

Of the 737 specifications involving engineering principles which were received and reviewed, 485 were passed as submitted, 170 required minor changes, and 82 required complete revision. Twenty-five individual specifications were prepared by the Board. Sixty-two bid dockets have been referred by the Chief of the Division of Purchase, Sales, and Traffic to the Board for review and recommendation prior to making an award. The Board recommended the award to other than the low bidder in 35 cases on which 6 informal complaints were received and disposed of and 1 formal protest entered. In 6 cases, the Board recommended revision of specifications and readvertisement, 1 of which resulted in a saving to the Government of over $100,000. In addition to the work enumerated above, several hundred cases were informally presented to the Board for review or consultation.

The Board has promulgated four standard specifications for passenger-carrying vehicles, which are now in general use. The Board has tentatively prepared standard specifications on crawler-type tractors, farm-type tractors, windmills, heavy-duty transport trucks bearing 20,000 pounds payload, stake and dump trucks bearing 4,500 pounds payload. Studies are in progress of the comments received from the bureaus on the proposed standardized specifications enumerated.

Through conferences with bureau officials and with representatives of various manufacturers, complex problems have been solved and

manufacturers have very heartily endorsed the activities and the policies of the Technical Advisory Board. The existence of such relationships resulted in a mutual understanding of problems common to both the Government and industry, and reduced complaints and protests.

During the year an inventory of motorized and mechanized heavy equipment (table 8), costing $200 or more, was obtained from all bureaus of the Department except the Bureau of Public Roads, Bureau of Biological Survey, and the equipment owned by the Civilian Conservation Corps.

TABLE 8.—*Inventory of Department-owned motorized and mechanized heavy equipment costing $200 or more*

Type of equipment	Units	New cost	Value as of Dec. 31, 1938
	Number	*Dollars*	*Dollars*
Farm equipment	2,064	1,184,558	688,434
Construction equipment	4,687	7,410,704	4,137,653
Automotive equipment	14,980	10,899,794	6,001,855
Miscellaneous equipment	1,351	1,005,085	675,748
Total	23,082	20,500,141	11,503,690

As the first important step in a progressive policy of consolidation of the far-flung repair activities on motorized, mechanized, and farm equipment of the Department, upon recommendation of the Board, the Secretary directed the establishment of consolidated repair depots at Missoula, Mont., Denver, Colo., and Albuquerque, N. Mex. A recent field survey indicated that additional consolidated repair-shop facilities could be established in the Pacific-coast area and elsewhere.

The departmental agencies primarily interested in the adoption of aerial photography to their land use problems, submitted to the Office of Land Use Coordination and the Technical Advisory Board for administrative and technical clearance, respectively, applications covering 381,745 square miles of territory in the United States.

For comparative purposes table 9 indicates the amount and cost of aerial photography executed during 1936–39. Attention is called to the diminution in costs which was the result of concerted effort and studies of methods and means of executing the work, and also the promulgation of standardized requirements, and planning seasonal geographic distribution of contracts.

TABLE 9.—*Aerial photography, 1936–39*

Fiscal year	Area contracted	Total contract cost	Contract cost per square mile
	Square miles	*Dollars*	*Dollars*
1936	256,696	1,237,416	4.82
1937	486,716	2,034,190	4.18
1938	647,635	2,052,935	3.17
1939	381,745	839,510	2.20
Total or average	1,772,792	6,164,051	3.48

An extensive and exhaustive review of the standard specifications for aerial photography for general map work and land studies with deviation authorized by the director of procurement for the Department of Agriculture, February 18, 1938, was made by special designated committees. As a result, there is now awaiting the approval of the Treasury Department a second revision which, when effective, should result in greater precision in aerial photography, much better photographs, and a much better understanding of the service requirements.

Action was initiated as the result of investigations made by the National Bureau of Standards to replace nitrate film by acetate film for the recording of aerial photography, thus eliminating an extremely hazardous fire potentiality.

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REPORT OF THE CHIEF OF THE BUREAU OF PUBLIC ROADS, 1939

PUBLIC ROADS ADMINISTRATION,
FEDERAL WORKS AGENCY,
Washington, D. C., September 1, 1939.

Honorable HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: Until July 1, 1939, this organization functioned as the Bureau of Public Roads of the Department of Agriculture. I, therefore, submit to you the report on the work of that Bureau for the fiscal year ended June 30, 1939.

Sincerely yours,

THOMAS H. MACDONALD, *Commissioner*,
(Formerly *Chief, Bureau of Public Roads.*)

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INTRODUCTION

More than 17,000 miles of highway of all types were completed during the year, exceeding the work of the previous year by about 1,800 miles and sustaining the high rate of progress initiated in the fiscal year 1934. In the program of grade-crossing elimination and

protection 382 crossings were eliminated, 86 obsolete elimination structures were reconstructed, and 438 crossings were protected by signals and other devices.

Outstanding features of the year's work were the large amount of work done in widening, straightening, and otherwise modernizing important main highways, the excellent progress made in eliminating hazards at railroad grade crossings, and the completion of nearly 3,000 miles of secondary roads in the program begun in the preceding year.

In the work done in cooperation with the States and under the immediate supervision of the State highway departments 9,786 miles were completed on rural portions of the Federal-aid system, 2,971 miles on the secondary or farm-to-market systems, and 725 miles were improved in municipalities. Improvements in federally controlled areas, reconstruction of flood-damaged roads, and construction of roads with funds allotted by other Federal agencies aggregated 3,678 miles.

The Bureau of Public Roads and all of its functions were transferred from the Department of Agriculture to the newly created Federal Works Agency, and its name was changed to the Public Roads Administration by Reorganization Plan No. 1 prepared by the President, pursuant to the provisions of the Reorganization Act of 1939. The plan was transmitted to Congress on April 25, 1939, and was made effective on July 1, 1939, by a Joint Resolution of Congress adopted June 7, 1939.

The reorganization plan transfers all functions of the Secretary of Agriculture relating to highway improvement with Federal aid to the Federal Works Administrator. The title of the Chief of the Bureau of Public Roads is changed to Commissioner of Public Roads.

The Federal Works Agency is headed by the Federal Works Administrator and is composed of the Public Roads Administration, the Public Buildings Administration, the United States Housing Authority, the Public Works Administration, and the Work Projects Administration.

FUTURE HIGHWAY NEEDS BECOMING CLEARLY EVIDENT

During the year the Bureau completed the first comprehensive study ever made of the national highway situation, taking into account conditions on city streets, main rural highways, and on secondary or farm-to-market roads. The study was possible because of the wealth of data that have become available through the highway-planning surveys in cooperation with 46 State highway departments. These data show accurately and in great detail the volume, character, and range of traffic, the condition of existing highways, and the need for new facilities.

As a result of exhaustive studies of these data the Bureau prepared a master plan for future highway improvement which was included in the report entitled, "Toll Roads and Free Roads." This report was submitted to the President, who on April 27, 1939, forwarded it to Congress with the recommendation that it be considered as a basis for needed action to solve our highway problems.

The report recommends:

1. The construction of a special tentatively defined system of direct interregional highways, with all necessary connections through and around cities,

designed to meet the requirements of the national defense in time of war and the needs of a growing peacetime traffic of longer range.

2. The modernization of the Federal-aid highway system.
3. The elimination of hazards at railroad grade crossings.
4. An improvement of secondary and feeder roads, properly integrated with land-use programs.
5. The creation of a Federal Land Authority empowered to acquire, hold, sell, and lease lands needed for public purposes and to acquire and sell excess lands for the purpose of recoupment.

A system of direct interregional highways, with necessary connections through and around cities, is needed to meet the growing peacetime traffic of longer range and the requirements of national defense in time of war. Studies of the present flow of traffic on main highways indicate that such an interregional system should comprise not more than 30,000 miles. No attempt has been made as yet to fix the exact location of the proposed system. Existing highways could be modernized to form a large part of the system, but some new highways would be needed to provide directness of travel. A system of the scope suggested would represent less than 1 percent of the total mileage of rural roads, but the Bureau estimates that it would serve at least 12.5 percent of the travel outside of cities.

The more complete information on the character of traffic in and near cities that has become available shows that existing facilities are seriously inadequate. The situation is becoming more aggravated by increases in traffic, and only the provision of major improvements at a large cost will provide a solution. Such improvements would be a necessary part of an interregional system.

It is found that as much as 90 percent of the traffic on main highways near the entrances to large cities is bound to or from points in cities themselves and cannot be bypassed around them. The studies reveal also that a large part of the traffic is destined to or bound from points in the very heart of the city or points most conveniently reached by going through the center of the city.

There is need for express highways cut directly into and through the center of the big cities. These are needed not only for service of the through traffic delivered by the main rural highways but also for the daily in-and-out movement of local traffic between the downtown section and suburbs centering about the main highways at the periphery of the city.

By preference such express highways should be constructed as attractively landscaped depressed thoroughfares passing under all cross streets.

Bypasses—the remedy usually proposed for the relief of congestion on through streets in cities—are only a partial and, by themselves, a not very effective remedy. They are recommended around the smaller towns, and a new type of belt-line distribution road around cities is proposed. For maximum effectiveness, both the bypass and distribution highways must be free from cross traffic, parked vehicles, and developments immediately adjacent, to preserve their initial advantage against the encroaching growth of the urban community, which otherwise soon converts them into ordinary local streets.

Outside of city limits on the main highways there is need for modernization of the existing roads to ease curvature, reduce gradients, and extend sight distance in order more safely to serve fast-moving traffic. Near the cities, also, a steadily increasing mileage of four-lane divided highways is believed to be required.

Such improvements are required on most of the mileage of the Federal-aid and State highway systems, especially those parts built before the recent considerable increase in the travel speed of motor vehicles. For the most part they involve only local changes in the existing roads. By such changes the bulk of the highway traffic that moves between adjacent cities will be amply served. Many improvements of this kind were made in the Federal-aid work of the past year.

No Federal undertaking has met with stronger public support than has the program of elimination of hazards at railroad grade crossings. This work should be continued.

The plan proposed for future highway improvement includes improvement of a carefully selected mileage of secondary and feeder roads to give direct service to a larger number of rural dwellers. The selection would be made from among the 2,618,000 miles of roads outside of State and Federal-aid systems. Constituting about 83 percent of the country's total road and street mileage, these lesser roads serve at present only about 13 percent of the total vehicle mileage of traffic. Located on them, however, are the homes and working places of about 75 percent of the rural population. The purpose of the improvement of an additional mileage of these roads, therefore, is that of affording better access to rural property rather than the service of a large increment of traffic. The choice of the roads to be improved should be made in close comformity with a program looking to the promotion of economically and socially beneficial land use.

Creation of a Federal Land Authority, empowered to acquire and lease land for public purposes, and to acquire and sell excess land for the purpose of recoupment is only one of several steps that need to be taken toward a solution of highway right-of-way problems.

Engineers trying to create a system of modern highways are everywhere delayed, and the public is forced to pay high prices for needed land, because of laws and a procedure adopted in the days of horse-drawn vehicles. In some States construction may be delayed for months by numerous legal steps, the width finally acquired is often less than that needed for a modern highway, and practically always the steps necessary to acquire rights-of-way are delayed until conditions are unfavorable to the acquirement except at a high price. A marked improvement can be produced by study and revision of State laws.

This step alone will not solve the most serious part of the problem. Along main highways in need of widening and relocation adjacent land steadily increases in value. Buildings are erected and subdivisions are developed, so that the number of owners who must be dealt with constantly increases. As a result of their planning work highway officials can determine with considerable accuracy the land that will be needed in the next 20 years to provide for an adequate highway system.

It is proposed that the Federal Government supply the means of acquiring lands selected by State officials and hold such land subject to lease by the State over a period of 50 years on terms that would in that period amortize the initial cost.

There is no action more necessary than providing the means of obtaining rights-of-way before they increase further in price. In

and near the cities the cost of land for the needed improvements may often exceed the cost of construction. Continuation of the present policy will result in such high costs for land that funds may not be found to pay both land and construction costs. We are now paying dearly because in the past funds could be found only for immediate right-of-way needs. The mistake should not be repeated.

Experience in England and Canada in the taking of land in excess of that needed for highway improvement and in later reselling at a profit indicates that such a policy, under proper constitutional authority, might well be applied in this country. The fact that a rise in land value accompanies major highway improvement is well known, and it seems reasonable that the public should derive some benefit from the value it creates.

BUREAU RECOMMENDS AGAINST A SYSTEM OF TOLL HIGHWAYS

The report to Congress containing the above recommendations was made in accordance with the act of June 8, 1938, which directed the Chief of the Bureau of Public Roads to investigate and report his findings—

> with respect to the feasibility of building and cost of superhighways not exceeding three in number, running in a general direction from the eastern to the western portion of the United States and not exceeding three in number, running in a general direction from the northern to the southern portion of the United States, including the feasibility of a toll system on such roads.

The building of such a system was found to be entirely feasible from a physical standpoint, but it was also found that the system would not come within 50 percent of self-liquidation if operated as a toll facility and would not meet the most urgent highway needs of the Nation.

In studying the feasibility of a toll system, the Bureau selected six routes, located in accordance with the terms of the act and aggregating 14,336 miles. Detailed studies show that the cost of constructing this system for fast-moving traffic without crossing other highways or railroads at grade would be about $2,899,800,000, which is at the average rate of $202,270 per mile.

The average estimated annual expenditure for the period 1945–60, required for financing the construction, maintaining the property, and operating the facility would be $184,054,000, which is at the average rate of $12,840 per mile per year.

Estimates of the potential traffic on the proposed toll system were based on actual traffic counts on the main highways of the country and studies of the character of highway travel. A number of facts led to the conclusion that only a small portion of present traffic could be attracted to the toll system. Long-distance travel constitutes only a small fraction of the total travel. Counts made on east-west highways at stations established on a line extending from Canada to Mexico showed only 300 passenger vehicles crossing the line daily in transcontinental travel. The system could be expected to serve adequately only that portion of the traffic having origin and destination close to one of the six routes. Access to the highways would have to be controlled both for collection of tolls and to prevent interference with flow of traffic by entering vehicles. Vehicles traveling distances less than the spacing of access points would not use the toll roads.

It is estimated that the utilization of the system would average, during the period 1945–60, 12,450,000 vehicle-miles per day. Assuming toll charges of 1 cent per vehicle-mile for passenger vehicles and an average of 3.5 cents for trucks and busses, this travel would produce an average annual revenue of $72,140,000. This is considerably less than the $184,054,000 estimated average annual cost and leads the Bureau to conclude that the system studied could not be supported by toll collections.

The portion of the proposed system estimated to be most nearly self-supporting is the 172 miles from a point near Philadelphia, Pa., to a point near New Haven, Conn. With the increase in traffic expected by 1960, this portion of the system would earn slightly more than the estimated cost for that year.

The report states:

> If, as an actual test of the feasibility of a limited mileage of toll roads, it is the desire of the Congress to make provision for the construction of a section of highway of substantial length upon which there is a reasonable prospect of the recovery of the costs through tolls, it is recommended that such provision be made applicable to a section of highway, properly located, and extending from an appropriate point near Washington, D. C., to an appropriate point near Boston, Mass.

HIGHWAY SAFETY

The Bureau has consistently sought to reduce the number of deaths and accidents on highways by several courses of action in the belief that only the combined effort of many agencies in several directions can produce the desired results. It is felt that the past year has been one of real accomplishment in this field, but the progress has not been such that the situation can be viewed with complete satisfaction. No one can say how many lives have been saved by highway-railroad grade separations, road straightening and widening, divided highways, and road signs and road marking to direct traffic in proper channels. Such work has had special prominence in the State and Federal programs, and has undoubtedly contributed to the more favorable trend in accident statistics.

There is still a great lack of uniformity in essential features of State motor-vehicle and highway laws despite the availability of the vehicle code recommended by the National Conference on Street and Highway Safety. This code has been available for a number of years, but there are still many States with inadequate inspection of motor vehicles and with only a perfunctory examination before issuing a driver's license. Disciplining and control of delinquent drivers continues to be strikingly deficient in many instances.

It has been definitely determined that a relatively small group of accident-prone drivers experience a relatively large number of accidents. The danger from these drivers can be removed only through an efficient system of accident reporting, the keeping of accident records, and laws making the revocation of licenses mandatory for flagrant violations of traffic regulations.

Steps toward improvement of these conditions have been disappointingly slow. Each year a few States make improvements in their traffic laws, provide motor-vehicle inspection stations, make small additions to highway patrol forces, or make provision for accident reporting and the keeping of records. But throughout the country there is still a serious lack of uniformity in traffic laws and inadequate

enforcement machinery. Since there is no general sentiment against the more important safety proposals that have been made, the situation can be accounted for only by public and legislative inertia. Increased efforts should be made to bring all States to a high and uniform standard in motor-vehicle regulation and in the enforcement of the regulations.

PROGRESS MADE IN PROPORTIONING THE PHYSICAL DIMENSIONS OF HIGHWAYS

The Bureau is cooperating with a committee of the American Association of State Highway Officials in the development of design standards for the promotion of maximum safety of traffic and utility of highways. Research has been conducted and special studies made to aid the committee in establishing design standards. A policy on classifying highways recommended by the committee has been accepted by the association. Policies as to sight distance and the dimensions of modern road cross sections will soon be submitted to the association for consideration. The committee is being assisted in developing standards for the physical lay-out at highway intersections, and the marking of pavements and erection of signs to indicate "no-passing zones" on two-lane and three-lane highways.

For some years the Bureau has recommended that transition curves be inserted at each end of highway curves to avoid an abrupt change from a straight line to a curving path of travel. The recommendation has not always been accepted because of the additional calculations and field work required. To overcome this objection an easier method of making the calculations with the aid of special tables has been developed and made available in the book Transition Curves for Highways. The method simplifies both the calculations and the field work.

ROADSIDE IMPROVEMENT

Roadside improvement had its beginning in a small way many years ago but it received only slight impetus until the initiation of the emergency program of highway improvement in 1933. Since that time it has been mandatory that roadside improvement work be included in Federal-aid programs.

Six years of experience with roadside improvement have demonstrated that in building a properly conceived highway the road surface and the roadside cannot be treated separately but must be regarded as a single problem. Consideration of the roadside and the recreational use of highways are responsible for several trends that are becoming increasingly evident. Wider rights-of-way are being obtained; deep ditches have disappeared; wider shoulders are being used; slopes are flatter, more rounded, and planted to grass; footpaths are being built; and picnic areas and parking space at scenic views are now included in highway plans.

Increased attention is being given to roadside regulation and border control. Easements are being obtained to permit improvements beyond the limits of restricted rights-of-way. Rural zoning regulations are being adopted. Many of these specify the distance which buildings and billboards shall be set back from the highway.

NEW LEGISLATION INSURES FUNDS FOR HIGHWAY PLANNING WORK

At the close of the fiscal year Congress was considering a proposal to require the use of not to exceed 1½ percent of the regular Federal-aid funds apportioned to each State for highways and for elimination of hazards at railroad grade crossings in making surveys, plans, engineering investigations, and economic investigations of projects for future construction, either on the Federal-aid highway system and its extensions, or on secondary or feeder roads, or grade-crossing eliminations. The States would not be required to match Federal funds so used. The proposed legislation was enacted July 19, 1939.

This new authority will greatly facilitate the financing of future highway-planning-survey work in all States. Regulations requiring a use of funds in sufficient amount to obtain information required in planning Federal-aid work are being prepared.

DIVERSION OF HIGHWAY FUNDS

During the last decade there has been a very decided tendency on the part of legislative bodies to divert the proceeds of the special taxes on motor-vehicle owners and operators to purposes other than highways, particularly to relief purposes. Congress took cognizance of this fact by declaring in section 12 of the Hayden-Cartwright Act of June 18, 1934, that it is unfair and unjust to tax motor-vehicle transportation unless the proceeds of such taxation are applied to the construction, improvement, or maintenance of highways. The act provides that any State that applies to highway purposes a lesser amount of motor-vehicle fees and gasoline taxes than was provided by law on June 18, 1934, shall be penalized not more than one-third of the Federal-aid apportionments to which it would otherwise be entitled.

A continuous study of the State laws pertaining to disposition of the proceeds of the special taxes on motor-vehicle owners and operators and of their administration has been necessary in order to give reasonable effect to this legislation. Committees and members of State legislative assemblies, State highway officials, and citizens' organizations submit numerous inquiries each time that such assemblies are in session as to whether certain proposed legislation will constitute a diversion of the proceeds of the motor-user taxes. The requirement of this section is believed to have had a wholesome and restraining effect, and undoubtedly has prevented passage of many acts designed to divert highway funds that otherwise would have been enacted.

Since the Federal provision to discourage diversion became effective, a reduction has been made in Federal-aid apportionments to two States. On August 7, 1937, $250,000 was withheld from the apportionment to New Jersey for the fiscal year 1937, and on June 2, 1938, $472,862 was withheld from the apportionment to Massachusetts for the fiscal year 1938. Apparent acts of diversion in other States are under consideration at the present time.

USE OF FEDERAL AID IN FREEING TOLL BRIDGES ON THE FEDERAL-AID SYSTEM

An act of August 14, 1937, authorized the use of Federal-aid funds apportioned to any State in freeing toll bridges on the Federal-aid system. It permitted payment to the State of 50 percent of the

construction cost or reasonable value (whichever might be least) of bridges made free from tolls prior to July 1, 1939. The act also required that funds so paid should be used in matching unobligated Federal-aid funds available to the State. In effect this legislation permitted the Federal Government to pay an increased part or all of the cost of certain Federal-aid projects thus making available for the freeing of toll bridges the State funds that would otherwise be required for matching the Federal funds.

Alabama is the only State that has made use of this legislation. In the past two years $2,025,267 was paid to the State in connection with the freeing of 10 bridges and the payments were applied in lieu of State funds on regular Federal-aid projects.

An act of July 19, 1939, has extended the use of this plan of freeing toll bridges to July 1, 1941.

SOURCES OF FUNDS USED DURING THE YEAR

The work of the year was supported mainly by regular Federal-aid funds. The apportionment for the fiscal year was $125,000,000 for improvement of the Federal-aid system, $25,000,000 for secondary or farm-to-market roads, and $50,000,000 for elimination of hazards at highway-railroad grade crossings. Equal amounts had been provided for the preceding fiscal year, and portions of these funds remained available at the beginning of the past year.

Emergency funds for highway improvement were practically exhausted in the preceding year; and, while a few projects were carried over into the past year and completed, the volume of such work was not important. However, the work of grade-crossing elimination, supported by remaining portions of the $200,000,000 authorized by the Emergency Relief Appropriation Act of 1935, continued into the past year in considerable amount.

On December 29, 1938, the $135,000,000 authorized for the fiscal year 1940 was apportioned to the States after first deducting $3,375,000 for administrative expenses of the Bureau as required by law. The apportionment is shown in table 1.

TABLE 1.—*Apportionments of Federal Aid for the fiscal year 1940 for roads on the Federal-aid highway system, for secondary or feeder roads and for grade-crossing eliminations*

State	Federal-aid system	Secondary or feeder	Grade crossings	Total
Alabama	$2,068,493	$310,274	$393,552	$2,772,319
Arizona	1,423,400	213,510	125,461	1,762,371
Arkansas	1,702,583	255,387	343,731	2,301,701
California	3,793,823	569,073	728,856	5,091,752
Colorado	1,807,919	271,188	251,215	2,330,322
Connecticut	624,021	93,603	167,075	884,699
Delaware	487,500	73,125	97,500	658,125
Florida	1,335,020	200,253	277,471	1,812,744
Georgia	2,507,151	376,073	477,283	3,360,507
Idaho	1,223,119	183,468	161,779	1,568,366
Illinois	4,043,313	606,497	1,030,486	5,680,296
Indiana	2,425,913	363,887	506,736	3,296,536
Iowa	2,542,385	381,358	545,468	3,469,211
Kansas	2,585,837	387,876	504,959	3,478,672
Kentucky	1,824,345	273,652	356,846	2,454,843
Louisiana	1,436,747	215,512	310,856	1,963,115
Maine	873,455	131,018	135,191	1,139,664
Maryland	821,369	123,205	200,663	1,145,237
Massachusetts	1,375,489	206,323	408,286	1,990,098
Michigan	3,012,993	451,949	649,147	4,114,089

TABLE 1.—*Apportionments of Federal Aid for the fiscal year 1940 for roads on the Federal-aid highway system, for secondary or feeder roads and for grade-crossing eliminations*—Continued

State	Federal-aid system	Secondary or feeder	Grade crossings	Total
Minnesota	$2,704,164	$405,625	$524,721	$3,634,510
Mississippi	1,746,261	261,939	310,650	2,318,850
Missouri	2,986,426	447,964	596,184	4,030,574
Montana	2,032,384	304,858	261,252	2,598,494
Nebraska	2,044,283	306,642	347,689	2,698,614
Nevada	1,275,938	191,391	97,500	1,564,829
New Hampshire	487,500	73,125	97,500	658,125
New Jersey	1,321,366	198,205	389,614	1,909,185
New Mexico	1,595,294	239,294	166,957	2,001,545
New York	4,845,924	726,889	1,335,949	6,908,762
North Carolina	2,321,357	348,204	500,977	3,170,538
North Dakota	1,532,167	229,825	309,164	2,071,156
Ohio	3,583,189	537,478	833,853	4,954,520
Oklahoma	2,317,258	347,589	455,041	3,119,888
Oregon	1,638,823	245,823	224,953	2,109,599
Pennsylvania	4,221,088	633,163	1,128,616	5,982,867
Rhode Island	487,500	73,125	97,500	658,125
South Carolina	1,328,214	199,232	293,750	1,821,196
South Dakota	1,610,762	241,614	268,815	2,121,191
Tennessee	2,079,803	311,970	373,187	2,764,960
Texas	6,227,084	934,063	1,088,862	8,250,009
Utah	1,124,731	168,710	129,236	1,422,677
Vermont	487,500	73,125	97,500	658,125
Virginia	1,815,401	272,310	373,906	2,461,617
Washington	1,563,815	234,572	300,063	2,098,450
West Virginia	1,082,034	162,305	260,716	1,505,055
Wisconsin	2,413,315	361,997	486,074	3,261,386
Wyoming	1,249,044	187,357	132,134	1,568,535
District of Columbia	487,500	73,125	97,500	658,125
Hawaii	487,500	73,125	97,500	658,125
Puerto Rico	487,500	73,125	150,076	710,701
Total	97,500,000	14,625,000	19,500,000	131,625,000

EMPLOYMENT ON ROAD WORK

Employment on all highway work with Federal funds administered by the Bureau amounted to 1,121,007 man-months, a decrease of 11 percent as compared with the preceding year. This was expected since appreciable amounts of emergency funds had remained available at the beginning of the preceding fiscal year and had been expended largely in the first half of that year. A comparison of employment by corresponding months of the 2 years shows that there was a decrease of more than 36,000 men in both July and August, and 20,394 fewer men were employed in September. By December there was a difference of only 3,097 men, and the difference was small in the remaining months of the year. Table 2 shows the employment on Federal and State work by months in the fiscal years 1932–39.

TABLE 2.—*Comparison of employment during the fiscal years 1932–39 on all Federal and Federal-aid highway construction and on all Federal and State road work, including State maintenance, by months*

Month	Men employed on all Federal and Federal-aid highway construction							
	1932	1933	1934	1935	1936	1937	1938	1939
July	164,708	81,042	129,205	335,223	191,041	249,271	159,489	123,038
August	151,418	89,346	111,211	297,224	178,756	247,841	163,331	126,860
September	116,100	122,193	115,047	247,880	143,455	227,916	152,784	132,390
October	88,869	124,106	154,016	210,079	135,660	206,113	143,617	129,270
November	62,466	129,933	185,860	201,046	118,898	172,295	121,394	110,073
December	35,991	98,271	174,358	147,101	103,493	128,314	85,365	82,268
January	29,518	75,498	154,154	96,594	82,731	76,829	54,899	57,554
February	26,673	78,215	156,814	81,257	70,418	57,844	49,713	46,804
March	28,008	95,704	144,053	90,999	86,050	69,946	51,229	47,559
April	42,205	122,256	187,657	123,063	132,834	88,361	67,829	65,517
May	59,008	139,831	271,972	167,535	193,269	122,655	98,179	89,108
June	71,772	152,276	336,414	193,263	237,330	145,375	114,373	110,566
Total (man-months)	876,736	1,308,671	2,120,761	2,191,264	1,673,935	1,792,760	1,262,202	1,121,007

Month	Total men employed on all Federal and State highway construction and maintenance							
	1932	1933	1934	1935	1936	1937	1938	1939
July	385,349	305,372	332,277	549,203	375,442	435,971	334,536	322,508
August	389,949	333,403	329,813	531,034	382,846	433,533	351,853	323,650
September	356,617	374,405	337,973	498,151	340,073	414,147	346,444	337,638
October	330,104	373,246	384,029	450,322	323,374	389,966	330,942	350,090
November	289,316	371,667	420,069	426,603	290,523	353,971	314,067	341,832
December	244,971	290,465	362,031	323,700	252,229	288,248	255,530	266,629
January	229,189	266,443	315,989	240,414	202,884	210,027	196,858	200,999
February	218,218	255,256	306,090	221,406	200,451	190,336	177,675	176,079
March	211,549	279,213	296,265	217,539	227,586	200,794	179,420	169,155
April	245,843	299,882	345,278	282,740	287,478	226,286	213,802	187,523
May	259,615	330,138	466,504	331,000	374,191	299,063	272,316	220,923
June	280,636	359,605	545,013	362,339	423,466	313,149	294,240	252,316
Total (man-months)	3,441,356	3,839,095	4,441,331	4,434,451	3,680,543	3,755,491	3,267,683	3,149,342

Table 3 shows the employment on the various classes of work during the past year. Comparison with similar figures for the preceding year shows that employment on roads in national parks and forests, and public lands remained at substantially a constant level, while there was an increase of 11 percent in the regular Federal-aid highway and grade-crossing elimination work. The decrease in employment is due almost entirely to the near exhaustion of emergency funds.

TABLE 3.—*Direct job employment during the fiscal year 1939 on the several classes of Federal and Federal-aid road construction administered by the Bureau of Public Roads and State road construction and maintenance*

Month	Men employed on road construction										Men employed on road maintenance by State highway departments	Total men employed
	In whole or in part with Federal funds									With State funds only, on State highways		
	National-forest highways	National-park highways	Public-lands highways	Federal-aid highways and grade-crossing eliminations	Public Works highways	Works Program highways	Works Program grade-crossing eliminations	Loan-and-grant highways [1]	National work-relief highways			
July	1,995	3,141	244	95,980	2,019	4,398	5,391	5,920	2,950	30,564	168,906	322,508
August	2,276	3,294	251	102,160	2,170	3,521	5,183	5,004	3,001	26,649	170,141	323,650
September	2,901	3,135	245	108,288	1,988	3,466	4,631	4,454	3,282	32,054	173,194	337,638
October	2,926	3,175	268	107,276	1,866	2,454	3,738	4,751	2,816	35,426	185,394	350,090
November	2,439	2,849	296	89,809	1,502	2,038	3,376	5,562	2,202	28,439	203,320	341,832
December	1,835	2,056	163	66,256	869	1,495	2,611	5,171	1,812	21,223	163,138	266,629
January	962	1,836	211	44,960	833	878	1,576	4,680	1,618	15,254	123,191	200,999
February	742	1,312	193	35,987	606	678	1,199	5,031	1,056	12,011	117,264	176,979
March	679	1,621	306	35,790	392	570	1,083	6,140	978	11,063	110,533	169,155
April	766	2,044	341	49,685	376	732	1,311	9,679	583	12,877	109,129	187,523
May	1,269	2,328	495	67,623	393	809	1,451	14,248	492	15,696	116,119	220,923
June	2,288	3,090	481	84,026	300	779	1,660	17,660	282	20,177	121,573	252,316
Total (man-months)	21,078	29,881	3,494	888,840	13,314	21,818	33,210	88,300	21,072	261,433	1,766,902	3,149,342

[1] Projects transferred by the Public Works Administration for engineering supervision.

Not so many years ago highway construction almost ceased in the winter months except in the Southern States. A special effort to stimulate winter employment in the emergency program produced a definite increase that has been well sustained up to the present time. In the past year employment on work with Federal funds reached its lowest level in February, but even then it amounted to 38 percent of the figure for July.

The total employment for the year on work supervised by the Bureau—1,121,007 man-months—is the equivalent of an average full-time employment each month of 93,417 men. Industrial employment in the production and transportation of equipment and materials is estimated at 1.6 times the direct employment for work of the character done during the year, indicating an industrial employment of 1,794,000 man-months, and this, added to the direct employment, gives a full-time employment of 2,915,000 man-months, the equivalent of the full-time continuous employment of 243,000 men.

There was a slight increase over the preceding year in men employed on State construction not involving Federal funds and also in State maintenance forces. The total employment on work with State and Federal funds amounted to 3,149,342 man-months, or about 4 percent less than in the fiscal year 1938.

MILEAGE OF FEDERAL-AID SYSTEM

The Federal-aid system was designated as a result of the Federal Highway Act of 1921, and in accordance with the intention of the act there has been close adherence to the original system. Only minor revisions have been made to meet unforeseen conditions. The mileages have been changed slightly from year to year as estimated mileages or mileages along old roads have been replaced by the measured mileage on new construction.

The original system was limited to 7 percent of the rural road mileage within each State. When provision has been made for improvement of 90 percent of the designated system, an additional 1 percent is permitted and further additions are permitted on the same basis. This provision is becoming of increasing importance and has been taken advantage of by 25 States. During the past year the mileage of the system outside of Federal reservations increased by 1,704 miles due almost entirely to extensions beyond the original 7 percent.

The system in any State may exceed what would otherwise be the limiting mileage by an amount equal to the mileage of the system within Federal reservations. Additions to the system in reservations amounted to 628 miles bringing the total additions for the year to 2,332. System mileages by States are shown in table 4.

TABLE 4.—*Designated Federal-aid highway system mileage as of June 30, 1939*

State	Mileage of approved routes outside Federal reservations	Mileage of approved routes within Federal reservations	Total mileage of system	State	Mileage of approved routes outside Federal reservations	Mileage of approved routes within Federal reservations	Total mileage of system
Alabama	3,954		3,954	New Jersey [1]	1,595		1,595
Arizona [1]	1,617	597	2,214	New Mexico	3,271	377	3,648
Arkansas	4,826	249	5,075	New York [1]	9,241	16	9,257
California [1]	5,590	555	6,145	North Carolina [1]	7,300	506	7,806
Colorado	3,214	536	3,750	North Dakota	7,139	85	7,224
Connecticut [1]	1,046		1,046	Ohio [1]	7,126		7,126
Delaware [1]	817		817	Oklahoma	6,671	50	6,721
Florida [1]	2,747	12	2,759	Oregon [1]	3,270	482	3,752
Georgia [1]	5,845	128	5,973	Pennsylvania [1]	7,698	108	7,806
Idaho	2,608	778	3,386	Rhode Island [1]	521		521
Illinois [1]	9,059	8	9,067	South Carolina [1]	4,167	252	4,419
Indiana [1]	5,334		5,334	South Dakota	5,796	477	6,273
Iowa [1]	7,891	2	7,893	Tennessee	4,369	66	4,435
Kansas	8,699	15	8,714	Texas [1]	14,196	148	14,344
Kentucky	3,700	6	3,706	Utah [1]	2,085	146	2,231
Louisiana	2,740		2,740	Vermont	1,036		1,036
Maine	1,617	4	1,621	Virginia [1]	4,566	128	4,694
Maryland [1]	2,164		2,164	Washington	2,953	404	3,357
Massachusetts [1]	1,674		1,674	West Virginia	2,163	132	2,295
Michigan [1]	5,771	233	6,004	Wisconsin	5,508	133	5,641
Minnesota	7,102	291	7,393	Wyoming	3,222	337	3,559
Mississippi	3,406	193	3,599	Hawaii	623		623
Missouri [1]	8,001		8,001	Puerto Rico	1,152		1,152
Montana	4,569	1,074	5,643	District of Columbia	81		81
Nebraska	5,591	21	5,612				
Nevada [1]	1,979	87	2,066	Total	218,278	8,669	226,947
New Hampshire	968	33	1,001				

[1] Increased beyond 7 percent.

STATUS OF MAJOR FUNDS AND PROGRESS IN CONSTRUCTION

During the year construction work on 13,482 miles of highway was brought to completion, exclusive of work done in Federal areas and with special funds. The completed work included 9,786 miles on the Federal-aid system outside of municipalities, 586 miles on extensions of the system into and through municipalities, 139 miles of secondary or feeder roads in municipalities, and 2,971 miles of secondary or feeder roads outside of municipalities. Payments to the States for construction completed amounted to $186,718,071, as shown in table 5.

TABLE 5.—*Funds paid to the States during the fiscal year 1939*

State	Federal aid, 1917–33	Public Works, 1934–35	Works Program		Federal-aid system, 1936–40	Federal aid, secondary, or feeder	Federal aid, grade crossings	Total
			Highways	Grade crossings				
Alabama	$12,272	$319,249	$107,003	$261,899	$3,921,434	$337,738	$784,017	$5,743,612
Arizona		4,211	813	56,876	1,666,602	291,566	137,718	2,157,786
Arkansas		22,009	83,353	380,998	3,008,985	233,033	547,207	4,275,585
California		10,315	208,141	820,926	4,470,224	1,012,791	1,059,287	7,581,684
Colorado		12,571	912,482	642,251	1,921,010	529,955	241,803	4,260,072
Connecticut		37,446	94,830	61,452	584,431	36,168		814,327
Delaware		3,069	185,558	207,575	506,913		27,619	930,734
Florida		41,930	39,172	264,998	1,395,743	177,573	230,692	2,150,108
Georgia		701,750	934,368	960,097	2,191,030	339,193	136,234	5,232,672
Idaho		96,395	26,732	149,997	1,468,409	258,915	213,678	2,214,126
Illinois		198,712	241,121	570,463	4,881,292	1,035,883	1,540,434	8,467,905
Indiana		138,561	19,840	215,564	3,366,270	436,122	986,425	5,162,782
Iowa			18,605	122,825	3,828,741		795,940	4,766,111
Kansas		19,191	79,609	298,013	2,875,608	117,938	794,161	4,184,520

TABLE 5.—*Funds paid to the States during the fiscal year 1939*—Continued

State	Federal aid, 1917–33	Public Works, 1934–35	Works Program		Federal-aid system, 1936–40	Federal aid, secondary, or feeder	Federal aid, grade crossings	Total
			Highways	Grade crossings				
Kentucky		$67,131	$139,370	$390,033	$2,535,624	$226,196	$253,933	$3,612,287
Louisiana		166,762	147,748	694,037	1,480,810	195,262	172,846	2,857,465
Maine		13,022	55,613	77,167	1,258,684	117,923	278,552	1,800,961
Maryland		342,376	228,199	600,640	887,699	41,370	44,403	2,144,687
Massachusetts		171,265	129,475	417,964	1,322,404	51,549	200,801	2,293,458
Michigan			148,691	501,457	2,492,078	368,075	572,183	4,082,484
Minnesota		121,772	17,755	101,239	2,772,442	303,819	504,427	3,821,454
Mississippi	$6,084	134,916	113,531	427,802	2,778,925	98,442	363,170	3,922,870
Missouri		51,996	87,962	249,733	2,143,332	281,070	367,983	3,182,076
Montana		40,504	48,719	61,011	867,677	31,549	565,427	1,614,887
Nebraska		63,627	188,039	178,837	2,511,908	484,742	559,217	3,986,370
Nevada		15,305	68,353	68,652	1,758,959	315,717	218,903	2,445,889
New Hampshire		20,244	77,663	58,523	426,956	69,519	89,093	741,998
New Jersey		129,829	92,408	335,421	1,208,924	78,362	178,215	2,023,159
New Mexico		8,860	53,530	15,822	1,840,918	543,455	188,678	2,651,263
New York		400,583	394,247	967,600	6,984,667	993,950	1,376,133	11,117,180
North Carolina		69,293	310,683	1,115,989	3,219,110	493,767	669,064	5,877,906
North Dakota	12,956	241,699	294,899	251,816	2,251,182	97,719	531,186	3,681,457
Ohio		31,553	486,669	1,494,480	3,338,584	93,956	17,758	5,463,000
Oklahoma		81,839	128,766	440,061	2,992,373	219,958	135,872	3,998,869
Oregon		156,081	78,830	247,307	1,669,215	274,581	82,906	2,508,920
Pennsylvania	64,137	185,784	898,323	1,259,075	4,697,248	1,039,404	256,911	8,400,882
Rhode Island		2,478		9,433	311,142	85,841	311,190	720,084
South Carolina		139,622	129,142	521,786	1,869,323	365,070	208,592	3,233,535
South Dakota		80,953	109,014	399,411	1,985,427	229	280,153	2,855,187
Tennessee		5,295	155,529	357,202	3,032,664	274,770	99,568	3,925,028
Texas		180,524	185,151	1,192,457	8,582,395	1,897,032	1,331,920	13,369,479
Utah			103,012	69,549	1,688,103	350,396	108,145	2,319,205
Vermont			32,811	45,908	573,517	93,936	77,283	823,455
Virginia		116,978	387,944	270,938	3,133,542	483,971	505,576	4,898,949
Washington		18,982	52,847	176,641	2,145,571	313,323	703,273	3,410,637
West Virginia	968	279,819	174,202	351,891	1,329,829	138,677	339,564	2,614,950
Wisconsin		30,040	17,215	545,748	3,192,865	479,701	738,658	5,004,227
Wyoming		42,972	20,859	78,610	1,393,083	347,277	80,967	1,963,768
District of Columbia							126,452	126,452
Hawaii		21,248	47,700	34,557	545,200	39,474	157,383	845,562
Puerto Rico					314,260	45,681	76,066	436,007
Total	96,417	5,038,761	8,556,526	18,992,731	117,623,332	16,142,638	20,267,666	186,718,071

Details concerning the status of the various funds by States and by classes of highways are shown in tables 6 to 9. The mileages of highway according to status, by States, and by class of highways are shown in tables 10, 11, and 12. Similar information for grade-crossing work is shown in table 13. Tables 14, 15, and 16 show the mileage by types in the different stages leading up to completion. The tables are so arranged that each shows all funds or all mileage in a given status.

PUBLIC WORKS AND WORKS PROGRAM HIGHWAY CONSTRUCTION

These emergency programs to provide employment have been financed with authorizations totaling $800,000,000 made in the calendar years 1933–35. The highway work with these funds was very nearly completed in preceding fiscal years. The accomplishment of the past year is, therefore, small.

In the combined emergency programs, and including the length of road surfaces improved in the emergency program of grade-crossing elimination, 564 miles were improved. This mileage included 117 miles in the Public Works program, 358 miles in the Works Program, and 89 miles of surface in connection with Works Program grade-crossing eliminations. Details concerning this work will be found in tables 6 to 12.

PROGRESS IN FEDERAL-AID ROAD CONSTRUCTION

Improvement of the Federal-aid system was carried on with funds remaining from the previous fiscal year and under an authorization of $125,000,000 for 1939 provided by the act of June 16, 1936. The apportionment of this fund was shown in the last annual report.

During the year 10,057 miles of highway financed with $128,220,989 of Federal-aid funds were brought to completion. These projects involved $121,629,657 of State funds. Payments to the States for completed work, including work done on projects still under construction, amounted to $117,719,749.

At the close of the year projects under contract and in large part under construction included 7,295 miles of highway at an estimated cost of $227,324,289 to be provided as follows: $113,121,919 Federal-aid and $114,202,370 from State funds. At the same time projects had been approved, but not yet contracted for, covering 2,110 miles, and involving $23,819,863 of Federal-aid funds and $24,615,523 of State funds.

On June 30, 1939, there remained available for new projects $133,629,011 of Federal-aid funds. In greater part they were funds provided for 1940. Tables 6 to 12 show the status of the work by States.

PROGRESS IN CONSTRUCTION OF SECONDARY ROADS WITH FEDERAL AID

Improvement of secondary roads as a part of the regular Federal-aid was begun in the preceding fiscal year with an authorization of $25,000,000 and an equal amount was made available for the past fiscal year. It is required that these funds be matched with State funds according to the usual Federal-aid plan.

In a number of States this work has not been prosecuted at the rate permitted by Federal funds. Where State funds have been insufficient to permit expenditures on secondary roads or where authority for such expenditures has been lacking, local authorities have been asked to raise required amounts and place them under State control.

Lack of State funds with which to match Federal-aid for secondary roads is still retarding this work, but there was a considerable gain in momentum during the past year when 2,717 miles were completed. At the end of the year 2,315 miles were under contract and 555 miles were approved but not under contract. The mileage completed cost $28,755,838, the Federal Government contributing $14,268,844 of this amount. The mileage under contract is to cost $31,693,820 of which $15,721,517 is to be Federal-aid. The projects approved but not under contract are estimated to cost $6,607,416 and $3,110,405 has been assigned as Federal-aid. Tables 6 to 12 show the status of the work.

The cost of secondary roads in this program has varied greatly, being particularly influenced by local conditions and by availability of suitable materials.

PROGRAM OF GRADE-CROSSING ELIMINATION AND PROTECTION

The accomplishment of the year in eliminating 382 railroad-highway crossings, reconstructing 86 obsolete separation structures, and in protecting 438 crossings by signals or other safety devices is an

important contribution to highway safety and will save much delay and inconvenience to public travel. A portion of the work done was in the emergency program of grade-crossing elimination financed by $200,000,000 authorized by the Emergency Relief Appropriation Act of 1935. In this program 173 crossings were eliminated, 38 elimination structures were reconstructed, and 154 crossings were protected. Costs were met almost entirely with Federal funds which amounted to $23,557,056. The fact that more than half of the expenditure was in municipalities reflects the relatively greater dangers and delays at city and suburban crossings.

In the regular Federal-aid program of grade-crossing elimination initiated in the preceding year, and for which $50,000,000 was authorized for each of the fiscal years 1938 and 1939, 191 crossings were eliminated, 48 existing structures were reconstructed, and 258 crossings were protected. Federal funds involved in this work amounted to $15,630,604.

Since the Public Works program started in 1933, 2,938 crossings have been eliminated and 434 obsolete elimination structures have been reconstructed. The most dangerous and, therefore, the most important grade crossings are rapidly being done away with in every State. The substantial program of railroad-highway grade-crossing elimination is considered one of the most advanced and productive undertakings of the present period of highway development.

At the end of the year work under contract consisted of 453 crossing eliminations, 75 elimination structures being reconstructed, and 947 crossings being protected. Table 13 shows details of the work by States and also the number of projects approved but not under contract at the end of the year.

SUMMARY

The year's work with the funds apportioned to all States resulted in the completion of 13,482 miles of highway and the elimination of 382 railroad-highway grade crossings, the reconstruction of 86 grade-separation structures, and the protection of 438 crossings at a cost of $196,566,311 in Federal funds and $139,524,945 in State funds. The types of highway completed are shown in table 14.

The completed work was divided as follows: 9,786 miles on the Federal-aid system outside of municipalities, 586 miles of extensions of the system into and through municipalities, 139 miles of secondary roads in municipalities, and 2,971 miles of secondary roads outside of municipalities. Federal funds involved in the respective classes of work were $135,452,188, $27,187,758, $10,470,759, and $23,455,606.

The roads under contract at the end of the year totaled 10,012 miles and involved $183,723,534 of Federal funds, and there were 2,718 miles approved but not yet contracted for, involving $34,465,125 of Federal funds. Unobligated balances available for new work totaled $228,180,129, in large part newly apportioned funds for the fiscal year 1940. Tables 15 and 16, respectively, show the types of road under contract and the types approved but not yet under contract.

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TABLE 6.—*Funds allotted to projects completed during the fiscal year 1939*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways	Grade crossings		
Alabama		$40,663		$3,058,669	$1,980	$3,101,312	$6,734,706
Arizona				1,793,274	30,741	1,824,015	2,537,073
Arkansas	$14,970	87,538	$258,602	1,726,501	526,925	2,614,536	2,635,258
California	22,501			5,159,590	945,053	6,127,144	10,539,193
Colorado		638,349	39,474	1,837,715	25,787	2,541,325	4,140,597
Connecticut	1,970		103,770	480,316		586,056	1,080,039
Delaware		9,640	279,052	353,975	4,129	646,796	1,010,709
Florida	39,920	38,957	49,918	1,697,762	10,616	1,837,173	3,623,918
Georgia	158,952	215,251	531,768	2,432,310	28,650	3,366,931	6,060,099
Idaho		1,401		1,230,138	222,100	1,453,639	2,403,450
Illinois		5,000	235,000	5,232,520	241,780	5,714,300	11,036,393
Indiana	80,035	49,000	122,950	2,953,345	494,759	3,700,089	7,411,917
Iowa		6,468		3,719,722	370,804	4,096,994	8,223,646
Kansas		74,925	78,694	2,885,123	471,985	3,510,727	6,458,830
Kentucky	10,597	6,388	97,078	2,678,600	11,790	2,804,453	5,555,538
Louisiana	44,459	43,356	199,500	712,915	91,980	1,092,210	1,827,364
Maine		25,152	87,529	1,479,791	5,287	1,597,759	3,142,302
Maryland	81,446	135,182	29,553	609,522		855,703	1,472,725
Massachusetts		436,840	7,250	969,267		1,413,357	2,821,595
Michigan		94,521	169,432	2,919,388	479,602	3,662,943	7,008,201
Minnesota				2,057,036	4,562	2,061,598	4,243,772
Mississippi	44,210		296,500	2,510,414	210,500	3,061,624	6,370,430
Missouri	30,000	121,709	92,132	2,916,184	163,111	3,323,136	6,483,152
Montana	7,599	34,485	108,864	1,280,832	253,298	1,685,078	2,694,027
Nebraska			33,080	2,218,126	172,676	2,423,882	4,948,012
Nevada				1,914,681	234,082	2,148,763	2,490,725
New Hampshire		14,178	13,542	623,256	65,175	716,151	1,360,425
New Jersey			146,511	1,113,177	75,000	1,334,688	2,513,082
New Mexico				1,777,097	99,112	1,876,209	2,857,913
New York	184,899	25,863	39,974	7,010,853	685,000	7,946,589	15,648,866
North Carolina		6,240	123,129	3,433,127	124,340	3,686,836	7,496,558
North Dakota	82,735	43,009	48,112	3,246,402	23,687	3,443,945	3,731,666
Ohio			1,570,560	4,027,118		5,597,678	9,774,124
Oklahoma		86,066	165,922	3,488,618	34,223	3,774,829	7,054,594
Oregon				1,828,245	31,372	1,859,617	3,186,628
Pennsylvania		32,458	930,415	3,977,963	122,837	5,063,673	9,223,967
Rhode Island				488,260		488,260	994,913
South Carolina	99,580		147,691	2,187,400	43,715	2,478,386	5,238,888
South Dakota	86,850	66,749	106,924	1,298,389	91,069	1,649,981	2,682,968
Tennessee		41,923	58,560	3,144,246	14,381	3,259,110	6,462,605
Texas	1,910			8,489,084	609,529	9,100,523	17,851,228
Utah		31,007	18,461	1,008,555	105,463	1,163,486	1,642,378
Vermont				581,795	149,106	730,901	1,430,170
Virginia		36,032	1,256	3,659,632	212,106	3,909,026	7,593,412
Washington		20,432	66,900	2,453,940	103,983	2,645,255	4,919,827
West Virginia	23,168		237,707	1,318,324	93,060	1,672,259	2,377,402
Wisconsin	17,037		81,210	2,206,460	200,987	2,505,694	4,769,893
Wyoming	26,356	20,859		1,790,240	145,205	1,982,660	3,141,521
Hawaii		50,888	169,698	637,043	48,630	906,259	1,560,504
Puerto Rico				347,080	61,550	408,630	765,266
Total	1,059,194	2,540,529	6,746,718	116,964,020	8,141,727	135,452,188	247,232,469

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

Alabama			$124,293	$154,001	$25,400	$303,694	$470,652
Arizona				6,645		6,645	10,558
Arkansas	$500		14,023	66,182	47,685	128,390	131,037
California				836,607	203,970	1,040,577	1,752,543
Colorado		$7,015		99,005		106,020	189,059
Connecticut			295,180	101,905		397,085	512,440
Delaware				12,855		12,855	25,837
Florida			19,820	50,000		69,820	119,820
Georgia	196,781	529,445	49,310	268,650		1,044,186	1,349,776
Idaho			1,053	20,552	27,044	48,649	63,305
Illinois	449,485		1,020,300	1,253,188	266,800	2,989,773	4,387,196
Indiana	55,526			123,344		178,870	311,027
Iowa		27,513	78,500	296,409	632,993	1,035,415	1,392,710
Kansas	20,885	155,944	1,160,375	132,204	117,580	1,586,988	1,736,366
Kentucky	74,808	172,661	417,814	188,671	153,898	1,007,852	1,203,377
Louisiana			120,820	38,073		158,893	199,886
Maine	8,645			39,000		47,645	90,083
Maryland	98,801		2,120			100,921	121,143

TABLE 6.—*Funds allotted to projects completed during the fiscal year 1939*—Contd.

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES—Continued

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal Funds	Estimated total cost
		Highways	Grade crossings	Highways	Grade crossings		
Massachusetts		$4,000		$338,298	$19,795	$362,093	$700,514
Michigan		43,400	$35,000	1,029,852	184,488	1,292,740	2,537,841
Minnesota	$170,471		407,520	423,157	6,250	1,007,398	1,524,377
Mississippi	54,350	73,950	104,847	368,610	146,100	747,857	1,132,027
Missouri		347,910	8,380	109,943	155,240	621,473	737,857
Montana	40,949	60,900		14,258	107,474	223,581	234,677
Nebraska		199,607	72,668	56,771		329,046	392,765
Nevada			3,525			3,525	3,661
New Hampshire				24,682		24,682	49,957
New Jersey	83,092			367,995		451,087	828,568
New Mexico	4,897	11,237	2,790	42,248		61,172	88,240
New York	70,500	22,147	263,750	713,776		1,070,173	1,930,552
North Carolina	7,036	15,352		280,247	84,840	387,475	680,219
North Dakota	234,103	294,991		87,739	337,300	954,133	963,152
Ohio		395,780	1,151,422	622,881		2,170,083	2,804,734
Oklahoma	21,970		6,173	74,037	29,450	131,630	213,811
Oregon	22,750			181,900	563,493	768,143	884,536
Pennsylvania	20,802	587,301	1,076,115	381,482		2,065,700	2,644,886
Rhode Island				193,590		193,590	387,180
South Carolina	10,450	141,878	68,649	216,678	25,780	463,435	775,466
South Dakota	12,067	164,326	62,038	21,397	13,723	273,551	290,862
Tennessee				298,667	32,270	330,937	635,172
Texas	39,431	46,000	2,571	660,305	442	748,749	1,452,416
Utah				249,863	1,685	251,548	369,078
Vermont				28,618		28,618	61,850
Virginia	13,179	9,800	568,954	105,067	147,790	844,790	951,751
Washington				85,023		85,023	164,681
West Virginia	680		212,500	141,690	94,021	448,891	510,246
Wisconsin		4,000	37,363	433,799		475,162	922,400
Wyoming	14,101		75,989	17,105		107,195	122,790
Total	1,726,259	3,315,157	7,463,862	11,256,969	3,425,511	27,187,758	39,063,081

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Secondary or feeder	Grade crossings		
Alabama				$3,550	$35,254	$38,804	$42,354
Arkansas			$4,656	9,255	41,207	55,118	55,200
California		$21,938			212,760	234,698	234,698
Colorado			332,090	29,466	5,775	367,331	391,144
Connecticut				5,780		5,780	11,560
Delaware					2,000	2,000	2,000
Florida			42,097		6,800	48,897	49,212
Georgia		264,445	451,556	15,359		731,360	776,871
Idaho				3,310		3,310	7,778
Illinois		5,600	48,189	73,845	25,660	153,294	229,355
Indiana				2,492		2,492	5,500
Iowa					3,000	3,000	3,023
Kansas				22,040	2,898	24,938	46,987
Kentucky		33,386	153,396	413	57,800	244,995	249,721
Louisiana			367,720			367,720	367,736
Maine				17,200		17,200	37,085
Maryland			77,238			77,238	77,238
Massachusetts				3,830	54,710	58,540	62,370
Michigan					226,082	226,082	237,677
Minnesota				18,093	33,770	51,863	70,588
Mississippi		34,100	22,200			56,300	56,300
Missouri			552,038	2,573		554,611	557,486
Montana			131,000			131,000	140,389
Nebraska		7,919	89,007	20,234		117,160	143,674
Nevada				181	5,876	6,057	6,116
New Hampshire					4,590	4,590	4,590
New Jersey			214,981		108,715	323,696	323,696
New Mexico					106,222	106,222	106,222
New York		37,988	1,095,900	8,980	111,663	1,254,531	1,264,493
North Carolina		38,982	134,600	44,358	55,720	273,660	318,840

TABLE 6.—*Funds allotted to projects completed during the fiscal year 1939*—Contd.

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES—Continued

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Secondary or feeder	Grade crossings		
North Dakota		$12,314	$364,000	$3,147	$184,700	$564,161	$567,209
Ohio		134,509	744,043			878,552	1,035,638
Oklahoma		55,767	144,700	6,794		207,261	221,376
Oregon				1,071		1,071	2,059
Pennsylvania		210,875	285,377	9,030		505,282	566,850
South Carolina		79,922	145,628	4,900	40,826	271,276	286,288
South Dakota			790			790	790
Tennessee		171,578	485,386			656,964	696,492
Texas		60,474	2,638	65,903	381,936	510,951	600,095
Utah				42,736		42,736	80,259
Vermont				14,650	3,470	18,120	36,650
Virginia			4,348	10,518	77,882	92,748	148,160
Washington				24,153	248,099	272,252	294,850
West Virginia			406,400		58,900	465,300	465,300
Wisconsin			336,552	65,336		401,888	480,933
Wyoming				3,675	5,030	8,705	11,071
District of Columbia					30,215	30,215	30,215
Total		1,169,797	6,636,530	532,872	2,131,560	10,470,759	11,404,138

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

Alabama		$141,414	$106,600	$136,162	$215,657	$599,833	$741,526
Arizona				329,737		329,737	506,576
Arkansas				92,562		92,562	99,232
California				1,065,263		1,065,263	1,918,647
Colorado		36,275		577,081	58,186	671,542	1,202,142
Connecticut			254,140	47,435		301,575	349,450
Delaware				11,365	59,760	71,125	82,969
Florida			59,610	10,061		69,671	79,732
Georgia	$313,843	687,693	151,242	237,161		1,389,939	1,719,634
Idaho			59,956	218,831		278,787	552,249
Illinois	96,529	188,117	135,900	904,085	29,040	1,353,671	2,328,786
Indiana			16,300	315,575	131,459	463,334	909,916
Iowa					4,288	4,288	4,294
Kansas		16,956		103,582	4,070	124,608	228,279
Kentucky		44,323	17,858	243,458	26,200	331,839	893,592
Louisiana	153,236			107,635		260,871	397,702
Maine		12,132		188,794	48,960	249,886	447,952
Maryland	167,634	130,757	277,863			576,254	581,995
Massachusetts		521,293	521,380	59,225		1,101,898	1,683,294
Michigan		185,000		251,635	25,625	462,260	722,958
Minnesota	63,801			108,607	5,749	178,157	306,075
Missouri				248,397		248,397	518,359
Montana	35,985	44,144		7,865		87,994	96,497
Nebraska		50,994		272,092		323,086	629,976
Nevada			4,350	345,209	5,220	354,779	436,766
New Hampshire	20,244	97,965		102,285		220,494	327,953
New Jersey			246,680	79,020		325,700	418,500
New Mexico				521,681	59,315	580,996	916,764
New York	16,000	75,858	52,700	1,152,501	345,880	1,642,939	2,875,269
North Carolina		81,900	96,589	339,259	154,960	672,708	1,013,410
North Dakota	23,112	72,544		53,468		149,124	198,090
Ohio		48,731	378,930	73,767		501,428	611,016
Oklahoma	200,092	16,500		198,265		414,857	624,713
Oregon	35,000			272,929		307,929	512,823
Pennsylvania	12,000	320,245	218,128	891,307	75,086	1,516,766	2,653,534
Rhode Island				81,173		81,173	166,074
South Carolina	43,620	218,845		287,952		550,417	940,113
South Dakota	4,032	11,370	27,780	6,250	33,524	82,956	88,711
Tennessee	5,295	163,476	6,982	185,123	7,770	368,646	617,486
Texas	184,531	53,104	15,390	1,666,733	46,706	1,966,464	3,913,109
Utah	31,990			344,282	1,760	378,032	733,930
Vermont				91,551	78,038	169,589	283,710
Virginia	54,049	180,679		478,344	73,074	786,146	1,356,399
Washington			43,356	272,973	436,722	753,051	1,013,009
West Virginia	189,571			119,483		309,054	435,670
Wisconsin	13,003		18,212	260,953		292,168	572,312
Wyoming				250,890	4,757	255,647	415,474
Hawaii	14,000					14,000	14,000
Puerto Rico				123,966		123,966	250,901
Total	1,677,567	3,400,315	2,709,946	13,735,972	1,931,806	23,455,606	38,391,568

TABLE 6.—*Funds allotted to projects completed during the fiscal year 1939*—Contd.

TOTAL

State	Public Works, 1934-35	Works Program		Federal aid			Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings		
Alabama		$182,077	$230,893	$3,212,670	$139,712	$278,291	$4,043,643	$7,989,238
Arizona				1,799,919	329,737	30,741	2,160,397	3,054,207
Arkansas	$15,470	87,538	277,281	1,792,683	101,817	615,817	2,890,606	2,926,727
California	22,500	21,938		5,996,198	1,065,263	1,361,783	8,467,682	14,445,081
Colorado		681,639	371,564	1,936,720	606,547	89,748	3,686,218	5,922,942
Connecticut	1,970		653,090	582,221	53,215		1,290,496	1,953,489
Delaware		9,640	279,052	366,830	11,365	65,889	732,776	1,121,515
Florida	39,920	38,957	171,445	1,747,762	10,061	17,416	2,025,561	3,872,682
Georgia	669,575	1,696,834	1,183,876	2,700,961	252,520	28,650	6,532,416	9,906,380
Idaho		1,401	61,009	1,250,690	222,141	249,144	1,784,385	3,026,782
Illinois	546,014	198,717	1,439,389	6,485,708	977,930	563,280	10,211,038	17,981,730
Indiana	135,561	49,000	139,250	3,076,689	318,067	626,218	4,344,785	8,638,360
Iowa		33,981	78,500	4,016,131		1,011,085	5,139,697	9,623,673
Kansas	20,885	247,825	1,239,069	3,017,327	125,622	596,533	5,247,261	8,470,462
Kentucky	85,405	256,758	686,146	2,867,271	243,871	249,688	4,389,139	7,902,228
Louisiana	197,695	43,356	688,040	750,988	107,635	91,980	1,879,694	2,792,688
Maine	8,645	37,284	87,528	1,518,792	205,994	54,247	1,912,490	3,717,422
Maryland	347,881	265,939	386,774	609,522			1,610,116	2,253,101
Massachusetts		962,133	528,630	1,307,565	63,055	74,505	2,935,888	5,267,773
Michigan		322,920	204,432	3,949,240	251,636	915,797	5,644,025	10,506,677
Minnesota	234,272		407,520	2,480,193	126,700	50,331	3,299,016	6,144,812
Mississippi	98,560	108,050	423,548	2,879,023		356,600	3,865,781	7,558,757
Missouri	30,000	469,619	652,550	3,026,127	250,970	318,351	4,747,617	8,296,854
Montana	84,533	139,529	239,864	1,295,090	7,865	360,772	2,127,653	3,165,590
Nebraska		258,521	194,755	2,274,896	292,326	172,676	3,193,174	6,114,427
Nevada			7,875	1,914,681	345,390	245,178	2,513,124	2,937,268
New Hampshire	20,244	112,142	13,542	647,939	102,285	69,765	965,917	1,742,925
New Jersey	83,092		608,172	1,481,172	79,020	183,715	2,435,171	4,083,846
New Mexico	4,897	11,237	2,790	1,819,345	521,681	264,649	2,624,599	3,969,139
New York	271,400	161,855	1,452,324	7,724,629	1,161,481	1,142,543	11,914,232	21,719,180
North Carolina	7,037	142,474	354,318	3,713,373	383,616	419,861	5,020,679	9,509,027
North Dakota	339,950	422,858	412,112	3,334,141	56,615	545,687	5,111,363	5,460,117
Ohio		579,021	3,844,955	4,649,998	73,767		9,147,741	14,225,512
Oklahoma	222,062	158,333	316,795	3,562,656	205,059	63,672	4,528,577	8,114,494
Oregon	57,750			2,010,145	274,000	594,865	2,936,760	4,536,046
Pennsylvania	32,803	1,150,879	2,510,035	4,359,444	900,337	197,923	9,151,421	15,089,237
Rhode Island				681,850	81,173		763,023	1,548,167
South Carolina	153,650	440,645	361,968	2,404,078	292,852	110,321	3,763,514	7,240,755
South Dakota	102,949	242,445	197,532	1,319,786	6,250	138,316	2,007,278	3,063,331
Tennessee	5,295	376,977	550,928	3,442,913	185,123	54,421	4,615,657	8,411,755
Texas	225,871	159,579	20,598	9,149,390	1,732,636	1,038,613	12,326,687	23,816,848
Utah	31,990	31,007	18,461	1,258,418	387,018	108,908	1,835,862	2,825,645
Vermont				610,413	106,201	230,614	947,228	1,812,380
Virginia	67,228	226,511	574,558	3,764,699	488,862	510,852	5,632,710	10,049,722
Washington		20,432	110,256	2,538,963	297,126	788,804	3,755,581	6,392,367
West Virginia	213,419		856,608	1,460,013	119,483	245,981	2,895,504	3,788,618
Wisconsin	30,040	4,000	473,337	2,640,259	326,289	200,987	3,674,912	6,745,538
Wyoming	40,457	20,859	75,989	1,807,345	254,565	154,992	2,354,207	3,690,856
Hawaii	14,000	50,888	169,698	637,043		48,630	920,259	1,574,504
District of Columbia						30,215	30,215	30,215
Puerto Rico				347,080	123,966	61,550	532,596	1,016,167
Total	4,463,020	10,425,798	23,557,056	128,220,989	14,268,844	15,630,604	196,566,311	336,091,256

TABLE 7.—*Funds allotted to projects under contract on June 30, 1939*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways	Grade crossings		
Alabama	$17,000	$62,200	$60,519	$3,991,589	$129,324	$4,260,632	$8,260,658
Arizona		38,548	18,841	1,075,692	198,841	1,331,922	1,769,619
Arkansas	9,200			3,159,309	254,401	3,422,910	3,426,338
California		116,218	120,706	2,871,216	576,244	3,684,384	6,075,928
Colorado			7,316	2,058,442	86,904	2,152,662	3,793,340
Connecticut	20,709	21,280	25,684	691,803	12,665	772,141	1,477,819
Delaware				313,152		313,152	631,561
Florida				882,460	10,394	892,854	1,775,314
Georgia	88,747	79,834	422,459	2,968,156	322,630	3,881,826	6,849,984
Idaho	34,162	51,038	25,117	856,729	265,461	1,232,567	1,825,939
Illinois		135,310	206,666	4,412,166	1,243,535	5,997,677	10,492,166
Indiana		2,000		2,995,344	446,250	3,443,594	6,542,276
Iowa		77,425	168,000	2,129,534	143,300	2,518,259	5,217,219
Kansas				1,827,785	378,006	2,205,791	4,033,577
Kentucky		55,894	55,086	2,094,468	478,389	2,683,837	4,781,415
Louisiana			72,000	2,871,641	579,903	3,523,544	12,218,715
Maine	6,550			748,521	209,136	964,207	1,712,730
Maryland	50,000	175,161	409,299	1,403,536	78,188	2,116,184	3,526,748
Massachusetts			63,160	1,152,723	415,147	1,631,030	2,790,286
Michigan		32,649	94,491	2,111,637	608,526	2,847,303	4,987,844
Minnesota	19,289	79,000	199,417	3,188,364	220,594	3,706,664	6,959,262
Mississippi	37,880	24,650	50,222	2,786,688	260,261	3,159,701	8,081,705
Missouri				2,623,432	238,440	2,861,872	5,532,557
Montana				2,067,599	470,466	2,538,065	4,125,037
Nebraska		89,811	122,478	2,672,206	244,253	3,128,748	5,762,967
Nevada	6,682	33,646	30,169	825,234	174,634	1,070,365	1,199,728
New Hampshire				563,967	36,553	600,520	1,180,317
New Jersey		46,947	40,000	1,178,181	29,554	1,294,682	2,474,763
New Mexico		43,071	25,879	1,293,269	18,137	1,380,356	2,196,271
New York	98,100	512,925	45,016	5,361,905	973,280	6,991,226	12,680,606
North Carolina	8,895	63,733	130,699	3,134,247	351,600	3,689,174	6,826,041
North Dakota	2,640		63,600	134,581	371,180	572,001	688,820
Ohio	117,975	115,063	126,598	4,752,372	410,400	5,522,408	10,386,526
Oklahoma	11,446		107,500	969,127	112,825	1,200,898	2,100,551
Oregon	15,000	45,580	55,829	1,657,819	39,062	1,823,230	2,920,237
Pennsylvania	126,988	173,842	172,254	4,801,031	276,656	5,550,771	10,632,840
Rhode Island			6,781	459,516	274,191	740,488	1,200,981
South Carolina		40,530	226,341	1,262,486	97,502	1,626,859	3,215,343
South Dakota			16,140	2,500,050	170,160	2,686,350	4,663,869
Tennessee				1,787,808	17,489	1,805,297	3,593,165
Texas	171,264	179,840	163,700	6,203,663	965,732	7,684,199	14,115,903
Utah				1,239,077	61,898	1,300,975	1,790,468
Vermont		13,865	10,900	418,693	12,476	455,934	910,496
Virginia		54,790	55,358	1,509,037	427,301	2,046,486	3,559,652
Washington	25,000	46,591	46,426	1,494,358	276,016	1,888,391	3,375,503
West Virginia		33,471	40,169	828,854	154,824	1,057,318	1,893,123
Wisconsin	40,860	72,000	83,266	3,358,926	426,217	3,981,269	7,501,154
Wyoming		33,287	20,412	950,855	112,830	1,117,384	1,780,754
Hawaii	30,788			284,670	181,790	497,248	797,300
Puerto Rico				871,930	392,150	1,264,080	2,149,531
Total	939,175	2,550,199	3,588,498	101,805,848	14,235,655	123,119,375	226,484,886

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

Alabama	$343,800			$370,035	$81,800	$795,635	$1,209,375
Arkansas	300			129,590	4,641	134,531	134,998
California			$141,721	248,050	109,797	499,568	700,889
Colorado				163,250	218,211	381,461	515,250
Delaware				34,738	2,320	37,058	76,700
Florida				372,500	197,900	570,400	942,900
Georgia	167,085	$87,960	195,350	434,047	21,500	905,942	1,439,988
Idaho				371,045	15,074	386,119	631,138
Illinois	31,335		63,000	540,565	1,182,450	1,817,350	2,432,580
Indiana	17,500	79,491		229,830	24,708	351,529	582,978
Iowa			927,675	229,400	321,200	1,478,275	1,836,238
Kansas		24,288		38,567	239,332	302,187	356,164
Kentucky				183,053	43,445	226,498	457,501
Louisiana			225,000	275,420	162,145	662,565	987,653
Maine				7,960	197,520	205,480	213,440
Maryland	30,570	154,193		215,255		400,018	634,024
Massachusetts	4,380			518,970	104,220	627,570	1,146,650
Michigan				535,235	211,050	746,285	1,281,520
Minnesota	25,950		61,545	592,440	282,973	962,908	1,596,596

TABLE 7.—*Funds allotted to projects under contract on June 30, 1939*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES—Continued

State	Public Works, 1934-35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways	Grade crossings		
Mississippi		$9,100	$122,746	$89,710	$343,354	$564,910	$782,120
Missouri		274,561		145,236	898,000	1,317,797	1,514,303
Montana				59,236	150,614	209,850	255,614
Nebraska		4,088	6,760	84,978	323,791	419,617	504,595
Nevada				47,501	5,267	52,768	60,415
New Hampshire				29,328		29,328	50,429
New Jersey				584,302	121,112	705,414	1,290,916
New Mexico				1,524		1,524	2,444
New York	$77,500			327,932	328,674	734,106	1,066,389
North Carolina	33,336		77,330	176,640	853,605	1,140,911	1,361,231
North Dakota	35,130			7,025	242,300	284,455	338,952
Ohio			442,784	346,354	245,200	1,034,338	1,433,720
Oklahoma	512			77,347	82,230	160,089	225,642
Oregon				161,984	125,632	287,616	400,669
Pennsylvania	78,673			709,051	662,254	1,449,978	2,254,961
Rhode Island				108,937	164,600	273,535	382,844
South Carolina	14,021		40,930	15,000	343,170	413,181	431,581
South Dakota	4,180		12,870	32,240	30,230	79,500	105,730
Tennessee			5,950	247,887	268,220	522,057	769,944
Texas			279,990	218,795	947,350	1,526,135	2,213,815
Utah				396,730	22,630	419,360	737,970
Vermont					6,850	6,850	6,850
Virginia	11,600			54,305	6,509	72,414	144,019
Washington	11,596			133,500	2,424	144,520	265,379
West Virginia	160,141			139,827		299,968	401,595
Wisconsin				1,420,554	367,968	1,788,522	3,320,485
Wyoming				22,140	2,500	24,640	38,340
Hawaii				111,060		111,060	224,740
Total	1,047,609	633,681	2,603,691	11,316,071	9,964,770	25,565,822	37,771,274

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

Alabama			$15,000	$28,250	$948,700	$991,950	$1,052,613
Arizona			3,427		245,000	248,427	271,898
Arkansas				17,720		17,720	18,152
California			1,430		576,712	578,142	578,192
Colorado				1,790	250,805	252,595	254,025
Delaware				450	5,600	6,050	6,500
Florida			39,310	14,000	219,800	273,110	287,110
Georgia		$15,670	330,400	18,020	43,240	407,330	425,350
Illinois		25,878	87,000	18,850	206,390	338,118	398,090
Indiana				75	95,777	95,852	95,927
Iowa				180	130,300	130,480	139,973
Kansas				374	335,848	336,222	336,596
Kentucky				27,000		27,000	157,960
Maryland		180,000		375		180,375	180,750
Michigan				38,630	43,900	82,530	126,160
Minnesota			69,755	95,988	565,417	731,160	830,962
Mississippi			3,100			3,100	3,100
Missouri				6,051		6,051	12,102
Montana					276,614	276,614	276,614
Nebraska				14,793	444,667	459,460	474,253
Nevada					16,950	16,950	16,950
New Jersey		39,615			7,140	46,755	47,009
New York					210,458	210,458	211,258
North Carolina			651,430	20,355	40,640	712,425	732,780
North Dakota					75,960	75,960	75,960
Ohio			1,274,991	11,659	190,310	1,476,960	1,747,450
Oklahoma					36,855	36,855	36,855
Oregon				9,656	135,740	145,396	151,830
Pennsylvania				11,088	822,685	833,773	1,051,853
South Carolina		4,594	64,455	13,000	173,816	255,865	279,915
South Dakota			44,840		64,070	108,910	108,910
Tennessee				5,131	373,010	378,141	383,272
Texas		5,900		34,972	290,790	331,662	374,150
Utah		36,250		8,923	195,840	241,013	293,095
Vermont					6,440	6,440	6,440
Virginia		123,987			100,000	223,987	312,987
Washington				8,640	4,749	13,389	21,689
Wisconsin				26,248	365,405	391,653	418,234
Wyoming				7,590	17,790	25,380	29,750
Total		431,894	2,585,138	439,808	7,517,418	10,974,258	12,226,714

TABLE 7.—*Funds allotted to projects under contract on June 30, 1939*—Continued

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Secondary or feeder	Grade crossings		
Alabama				$412,500	$83,300	$495,800	$1,089,925
Arizona	$19,573	$185	$2,156	173,408		195,322	285,881
Arkansas				536,310	2,542	538,852	541,937
California	71,027		4,316	542,288	507,797	1,125,428	1,639,546
Colorado		640,020		326,076		966,096	1,298,120
Connecticut				72,417		72,417	172,794
Delaware				39,970	3,550	43,520	83,490
Florida				476,300	3,800	480,100	965,833
Georgia	117,640	541,591	229,750	214,412	75,970	1,179,363	1,393,776
Idaho				140,187		140,187	246,595
Illinois	48,000			766,466	210,620	1,025,086	1,956,552
Indiana				470,510	296,623	767,133	1,237,643
Iowa				21,835	100,406	122,241	175,385
Kansas				27,323	2,060	29,383	56,706
Kentucky		6,652		376,945	93,524	477,121	1,379,562
Louisiana		97,070		319,970		417,040	832,332
Maine		6,691		122,395	67,020	196,106	327,670
Maryland	127,881	170,000	211,700	110,612	42,200	662,393	799,470
Massachusetts				195,689		195,689	394,184
Michigan				612,422		612,422	1,224,844
Minnesota	157,460			309,330	100,851	567,641	901,125
Mississippi	120,000		5,600	348,881		474,481	823,462
Missouri				460,127	73,200	533,327	1,048,554
Montana				426,663		426,663	752,356
Nebraska				347,984	35,065	383,049	748,945
Nevada	15,297			104,184	2,035	121,516	137,501
New Hampshire				29,708	63,906	93,614	124,712
New Jersey	163,331			183,135	335,735	682,201	870,526
New Mexico				271,508	59,805	331,313	509,829
New York		54,000		949,450	488,700	1,492,150	2,442,700
North Carolina	30,383		143,330	622,200	130,940	926,853	1,558,397
North Dakota				61,606	14,170	75,776	129,200
Ohio		141,049		351,052	56,210	548,311	999,763
Oklahoma				44,156	70,770	114,926	153,756
Oregon	31,467		20,000	414,091		465,558	772,755
Pennsylvania	20,701	2,500		1,031,893	9,000	1,064,094	2,131,550
Rhode Island				49,644		49,644	99,335
South Carolina	36,400	63,114		226,069	83,078	408,661	763,779
South Dakota	5,391	30,037	218,790		75,600	329,818	388,430
Tennessee			207,490	299,358	6,050	512,898	922,716
Texas		102,649	2,950	1,013,305	621,860	1,740,764	2,848,637
Utah				97,941	95,610	193,551	276,990
Vermont				65,653	4,480	70,133	138,086
Virginia		31,800	40,100	257,071	89,320	418,291	690,354
Washington	10,000			356,356	19,261	385,617	706,911
West Virginia		65,400	100,923	76,648	202,657	445,628	538,036
Wisconsin			97,584	468,877	436,177	1,002,638	1,488,112
Wyoming				257,779	6,480	264,259	422,602
Hawaii				85,040		85,040	170,080
Puerto Rico				113,965		113,965	233,693
Total	974,551	1,952,758	1,284,689	15,281,709	4,570,372	24,064,079	39,895,137

TOTAL

State	Public Works, 1934–35	Works Program		Federal aid			Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings		
Alabama	$360,800	$62,200	$75,519	$4,361,624	$440,750	$1,243,124	$6,544,017	$11,612,571
Arizona	19,573	38,733	24,424	1,075,692	173,408	443,841	1,775,671	2,327,398
Arkansas	9,500			3,288,899	554,030	261,584	4,114,013	4,121,425
California	71,027	116,218	268,173	3,119,267	542,287	1,770,550	5,887,522	8,994,555
Colorado		640,020	7,316	2,221,693	327,866	555,919	3,752,814	5,860,735
Connecticut	20,709	21,280	25,684	691,803	72,417	12,665	844,558	1,650,613
Delaware				347,890	40,420	11,470	399,780	798,251
Florida			39,310	1,254,960	490,300	431,894	2,216,464	3,971,157
Georgia	373,472	725,054	1,177,959	3,402,203	232,433	463,340	6,374,461	10,109,098
Idaho	34,162	51,038	25,117	1,227,774	140,187	280,535	1,758,813	2,703,672
Illinois	79,335	161,189	356,666	4,952,730	785,316	2,842,995	9,178,231	15,279,388

TABLE 7.—*Funds allotted to projects under contract on June 30, 1939*—Continued

TOTAL—Continued

State	Public Works, 1934–35	Works Program		Federal aid			Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings		
Indiana	$17,500	$81,491		$3,225,174	$470,585	$863,358	$4,658,108	$8,458,824
Iowa		77,425	$1,095,675	2,358,933	22,015	695,207	4,249,255	7,368,815
Kansas		24,288		1,866,352	27,697	955,246	2,873,583	4,783,043
Kentucky		62,546	55,086	2,277,521	403,945	615,358	3,414,456	6,776,438
Louisiana		97,070	297,000	3,147,061	319,970	742,048	4,603,149	14,038,700
Maine	6,550	6,691		756,481	122,395	473,676	1,365,793	2,253,840
Maryland	208,451	679,354	620,999	1,618,791	110,987	120,388	3,358,970	5,140,992
Massachusetts	4,380		63,160	1,671,693	195,689	519,367	2,454,289	4,331,120
Michigan		32,649	94,491	2,646,872	651,052	863,476	4,288,540	7,620,368
Minnesota	202,698	79,000	330,717	3,780,804	405,319	1,169,835	5,968,373	10,287,945
Mississippi	157,881	33,750	181,668	2,876,398	348,881	603,614	4,202,192	9,690,387
Missouri		274,561		2,768,668	466,178	1,209,640	4,719,047	8,107,516
Montana				2,126,835	426,663	897,694	3,451,192	5,409,621
Nebraska		93,899	129,238	2,757,183	362,777	1,047,777	4,390,874	7,490,760
Nevada	21,979	33,646	30,169	872,735	104,184	198,886	1,261,599	1,414,594
New Hampshire				593,295	29,708	100,459	723,462	1,364,458
New Jersey	163,331	86,562	40,000	1,762,483	183,135	493,541	2,729,052	4,683,214
New Mexico		43,071	25,879	1,294,793	271,508	77,942	1,713,193	2,708,544
New York	175,600	566,925	45,016	5,689,837	949,450	2,001,112	9,427,940	16,400,953
North Carolina	72,614	63,733	1,002,789	3,310,887	642,555	1,376,785	6,469,363	10,478,449
North Dakota	37,770		63,600	141,606	61,606	703,610	1,008,192	1,232,932
Ohio	117,975	256,112	1,844,373	5,098,727	362,710	902,120	8,582,017	14,567,459
Oklahoma	11,958		107,500	1,046,474	44,156	302,680	1,512,768	2,516,804
Oregon	46,467	45,580	75,829	1,829,803	423,747	300,374	2,721,800	4,245,491
Pennsylvania	226,362	176,342	172,254	5,510,082	1,042,981	1,770,595	8,898,616	16,071,204
Rhode Island			6,781	568,451	49,644	438,791	1,063,667	1,683,160
South Carolina	50,421	108,238	331,786	1,277,486	239,069	697,566	2,704,566	4,690,618
South Dakota	9,571	30,037	292,620	2,532,290		340,060	3,204,578	5,266,939
Tennessee			213,440	2,035,695	304,489	664,769	3,218,393	5,669,037
Texas	171,264	288,389	446,640	6,502,458	1,048,277	2,825,732	11,282,760	19,552,505
Utah		36,250		1,635,807	106,864	375,978	2,154,899	3,098,523
Vermont		13,865	10,900	418,693	65,653	30,246	539,357	1,061,872
Virginia	11,600	210,577	95,458	1,563,342	257,071	623,130	2,761,178	4,707,012
Washington	46,596	46,591	46,426	1,624,858	364,996	302,450	2,431,917	4,369,482
West Virginia	160,141	98,871	141,092	968,681	76,648	357,481	1,802,914	2,832,754
Wisconsin	40,860	72,000	180,850	4,779,480	495,125	1,595,767	7,164,082	12,727,985
Wyoming		33,287	20,412	972,995	265,369	139,600	1,431,663	2,271,446
Hawaii	30,788			395,730	85,040	181,790	693,348	1,192,120
Puerto Rico				871,930	113,965	392,150	1,378,045	2,383,224
Total	2,961,335	5,568,532	10,062,016	113,121,919	15,721,517	36,288,215	183,723,534	316,378,011

TABLE 8.—*Funds allotted to projects approved but not under contract on June 30, 1939*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways	Grade crossings		
Alabama			$6,000	$144,500	$14,400	$164,900	$331,400
Arizona				24,768		24,768	39,861
Arkansas				110,653		110,653	110,703
California				32,471		32,471	59,808
Colorado				178,756		178,756	319,865
Connecticut				238,235	166,540	404,775	654,910
Delaware				591,871		591,871	1,209,658
Florida				768,573		768,573	1,537,146
Georgia				933,207	27,090	960,297	1,893,504
Illinois				500,545	475,000	975,545	1,496,280
Indiana				828,665	326,000	1,154,665	2,088,186
Iowa				238,900		238,900	517,186
Kansas				1,738,260	220,124	1,958,384	3,698,404
Kentucky			25,157	350,744	101,976	477,877	831,118
Louisiana		$22,800		400,575		423,375	853,544
Maine				535,950	90,800	626,750	1,162,700
Maryland				444,000		444,000	902,000
Massachusetts				321,457		321,457	645,579

TABLE 8.—*Funds allotted to projects approved but not under contract on June 30, 1939*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES—Con.

State	Public Works, 1934–35	Works Program		Federal aid		Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways	Grade crossings		
Michigan				$384,750	$70,000	$454,750	$842,500
Minnesota				417,328		417,328	837,511
Mississippi				298,264		298,264	833,860
Missouri				876,020	136,320	1,012,340	1,993,424
Montana				8,349		8,349	14,721
Nebraska				1,268,480	150,805	1,419,285	2,684,765
New Hampshire				188,792		188,792	382,161
New Jersey				312,010		312,010	724,020
New York				806,770	150,000	956,770	2,208,020
North Carolina				563,300		563,300	1,249,940
North Dakota	$99,106			1,732,338		1,831,444	3,340,164
Ohio				539,261	168,800	708,061	1,236,751
Oklahoma				1,334,963		1,334,963	2,518,299
Pennsylvania		$7,375		253,500		260,875	514,375
South Carolina				50,900		50,900	112,400
South Dakota				747,105		747,105	1,327,810
Tennessee				146,550		146,550	293,100
Texas				240,480	83,440	323,920	586,157
Utah				57,490		57,490	79,965
Vermont				12,765		12,765	25,530
Virginia	2,260			594,466	68,750	665,476	1,368,478
Washington				542,000		542,000	1,137,005
West Virginia				624,986		624,986	1,255,015
Wisconsin				130,000		130,000	314,779
Wyoming		314		187,684		187,998	297,631
Hawaii		3,443		372,578		376,021	758,190
District of Columbia				148,750		148,750	297,500
Puerto Rico				20,325		20,325	49,095
Total	101,366	33,932	$31,157	21,242,334	2,250,045	23,658,834	45,635,018

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

Alabama				$4,340		$4,340	$8,690
Arkansas				62,111		62,111	64,146
California			$10,000	188,600		198,600	391,870
Connecticut				104,369		104,369	209,694
Delaware				30,440		30,440	60,879
Florida				40,886	$75,900	116,786	158,122
Georgia	$55,544			252,733		308,277	567,447
Illinois	7,500			438,205		445,705	891,410
Indiana				48,595	143,300	191,895	240,490
Iowa				24,000	14,300	38,300	66,595
Kansas				52,780	232,272	285,052	337,832
Kentucky				32,278	96,254	128,532	160,810
Louisiana				110,000		110,000	220,835
Maine				48,808		48,808	97,616
Maryland				5,005		5,005	11,000
Massachusetts				444,540		444,540	891,459
Michigan				99,050		99,050	387,900
Minnesota				18,142	213,540	231,682	249,824
Mississippi				15,520		15,520	33,460
Missouri				45,578	277,800	323,378	405,478
Nebraska				58,147		58,147	116,295
New York				21,390	120,000	141,390	204,880
North Carolina				68,095		68,095	136,190
North Dakota		$5,106		22,689		27,795	47,446
Ohio				34,934	218,200	253,134	288,719
Oklahoma				93,222	73,000	166,222	248,492
South Carolina				2,100	15,100	17,200	19,900
South Dakota	4,261			9,845		14,106	25,040
Texas				3,580	190,680	194,260	206,368
Utah				500		500	850
Virginia				64,650	36,000	100,650	175,050
Washington				14,500		14,500	34,418
West Virginia				62,513		62,513	125,025
Wyoming				524		524	831
Hawaii				54,860		54,860	136,550
District of Columbia					250,000	250,000	283,544
Total	67,305	5,106	10,000	2,577,529	1,956,346	4,616,286	7,505,155

TABLE 8.—*Funds allotted to projects approved but not under contract on June 30, 1939*—Continued

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

State	Public Works 1934–35	Works Program grade crossings	Federal aid		Total Federal funds	Estimated total cost
			Secondary or feeder	Grade crossings		
Delaware			$2,115		$2,115	$4,230
Georgia			4,920	$68,970	73,890	78,810
Illinois			4,000		4,000	8,000
Indiana			180		180	360
Louisiana			29,700		29,700	60,959
Maryland				113,207	113,207	210,000
Minnesota			4,080		4,080	8,160
Missouri			7,190		7,190	14,568
Montana			3,835		3,835	6,762
Nebraska		$32,888	1,260	190,134	224,282	225,541
New York				403,500	403,500	535,361
North Carolina			6,855	158,230	165,085	171,940
North Dakota				269,900	269,900	269,900
Ohio				262,980	262,980	262,980
Oklahoma			3,010		3,010	5,900
Pennsylvania			400		400	800
Tennessee				81,920	81,920	81,920
Texas				85,000	85,000	105,140
Utah				279	279	279
Virginia				26,729	26,729	26,729
Washington			22,300	91,617	113,917	133,986
Wisconsin			1,650		1,650	3,355
Total		32,888	91,495	1,752,466	1,876,849	2,215,680

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

Arizona	$6,150		$11,475		$17,625	$22,062
Arkansas			22,703		22,703	22,703
California			50,895		50,895	86,988
Colorado			22,990		22,990	40,800
Delaware		$17,000	34,850		51,850	96,110
Georgia	10,820		61,840		72,660	134,500
Illinois			97,500		97,500	195,000
Indiana			173,118		173,118	385,817
Iowa				$23,200	23,200	25,072
Kansas			200,354		200,354	400,708
Kentucky			126,728		126,728	369,959
Louisiana			83,630	27,200	110,830	214,030
Maine			98,265		98,265	198,590
Maryland			35,855		35,855	107,000
Massachusetts			95,610		95,610	194,581
Michigan			117,450		117,450	262,300
Minnesota			46,485		46,485	92,970
Mississippi			3,400		3,400	6,900
Missouri			87,960		87,960	219,766
Montana			88,196		88,196	155,494
Nebraska			201,230		201,230	424,447
Nevada			44,685		44,685	51,737
New Hampshire				104,987	104,987	105,035
New Jersey			66,225	255,740	321,965	388,870
New York			127,000		127,000	372,200
North Carolina			47,755		47,755	107,860
North Dakota			22,907		22,907	42,770
Ohio	27,568		81,800	256,530	365,898	496,888
Oklahoma			306,588	105,800	412,388	725,340
Oregon			35,620		35,620	59,356
Pennsylvania			92,550	347,000	439,550	740,552
South Carolina			66,200		66,200	169,800
South Dakota			7,640		7,640	13,880
Tennessee				90,860	90,860	90,860
Texas			109,570		109,570	227,479
Utah			16,000		16,000	46,320
Vermont			32,900		32,900	65,800
Virginia	4,891		52,012		56,903	141,187
Washington			14,700		14,700	28,401
West Virginia				16,500	16,500	16,500
Wisconsin			58,350		58,350	158,164
Wyoming			164,424		164,424	261,424
Hawaii			11,450		11,450	22,900
Total	49,429	17,000	3,018,910	1,227,817	4,313,156	7,989,120

TABLE 8.—*Funds allotted to projects approved but not under contract on June 30, 1938*—Continued

TOTAL

State	Public Works, 1934–35	Works Program		Federal aid			Total Federal funds	Estimated total cost
		Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings		
Alabama			$6,000	$148,840		$14,400	$169,240	$340,090
Arizona	$6,150			24,768	$11,475		42,393	61,923
Arkansas				172,764	22,703		195,467	197,552
California			10,000	221,071	50,895		281,966	538,656
Colorado				178,756	22,990		201,746	360,665
Connecticut				342,604		166,540	509,144	864,604
Delaware		$17,000		622,311	36,965		676,276	1,370,877
Florida				809,459		75,900	885,359	1,695,258
Georgia	66,364			1,185,940	66,760	96,060	1,415,124	2,674,261
Illinois	7,500			938,750	101,500	475,000	1,522,750	2,590,690
Indiana				877,260	173,298	469,300	1,519,858	2,714,853
Iowa				262,900		37,500	300,400	608,853
Kansas				1,791,040	200,354	452,396	2,443,790	4,436,944
Kentucky			25,157	383,022	126,728	198,230	733,137	1,361,887
Louisiana		22,800		510,575	113,330	27,200	673,905	1,349,368
Maine				584,758	98,265	90,800	773,823	1,458,906
Maryland				449,005	35,855	113,207	598,067	1,230,000
Massachusetts				765,997	95,610		861,607	1,731,619
Michigan				483,800	117,450	70,000	671,250	1,492,700
Minnesota				435,470	50,565	213,540	699,575	1,188,465
Mississippi				313,784	3,400		317,184	874,220
Missouri				921,598	95,150	414,120	1,430,868	2,633,236
Montana				8,349	92,031		100,380	176,977
Nebraska			32,888	1,326,628	202,489	340,939	1,902,944	3,451,048
Nevada					44,685		44,685	51,737
New Hampshire				188,792		104,987	293,779	487,196
New Jersey				312,010	66,225	255,740	633,975	1,112,890
New York				828,160	127,000	673,500	1,628,660	3,320,461
North Carolina				631,395	54,610	158,230	844,235	1,665,930
North Dakota	99,106	5,106		1,755,027	22,907	269,900	2,152,046	3,700,280
Ohio	27,568			574,195	81,800	906,510	1,590,073	2,285,338
Oklahoma				1,428,184	309,599	178,800	1,916,583	3,498,031
Oregon					35,620		35,620	59,356
Pennsylvania		7,375		253,500	92,950	347,000	700,825	1,255,727
South Carolina				53,000	66,200	15,100	134,300	302,100
South Dakota	4,261			756,950	7,640		768,851	1,366,730
Tennessee				146,550		172,780	319,330	465,880
Texas				244,060	109,570	359,120	712,750	1,125,144
Utah				57,990	16,000	279	74,269	127,414
Vermont				12,765	32,900		45,665	91,330
Virginia	7,151			659,116	52,012	131,479	849,758	1,711,444
Washington				556,500	37,000	91,617	685,117	1,323,810
West Virginia				687,499		16,500	703,999	1,396,540
Wisconsin				130,000	60,000		190,000	476,298
Wyoming		314		188,208	164,424		352,946	559,886
Hawaii		3,443		427,438	11,450		442,331	917,640
District of Columbia				148,750		250,000	398,750	581,044
Puerto Rico				20,325			20,325	49,095
Total	218,100	56,038	74,045	23,819,863	3,110,405	7,186,674	34,465,125	63,344,973

TABLE 9.—*Balances of funds available for programmed projects on June 30, 1939*

State	Public Works 1934–35	Works Program		Federal-aid system	Federal aid, secondary or feeder	Federal aid, grade crossings	Total
		Highways	Grade crossings				
Alabama	$13,969	$18,343	$25,078	$3,101,328	$782,784	$842,733	$4,784,235
Arizona			18,357	1,825,489	355,372	281,092	2,480,310
Arkansas		18,137	61,953	1,738,388	440,945	1,225,099	3,484,522
California	1,604	1,041	109,634	4,293,753	758,464	1,296,732	6,461,228
Colorado		283,622	54,000	2,202,372	235,353	893,860	3,669,207
Connecticut	3,920	22,376	93,056	1,331,528	286,249	832,360	2,569,489
Delaware		61,467	11,212	1,008,742	231,250	513,891	1,826,562
Florida	8,243	46,358	143,122	2,904,467	374,744	1,158,058	4,634,992
Georgia	169,268	219,375	1,165,561	5,652,962	1,083,865	2,306,620	10,597,651
Idaho	13,781	6,494	28,893	1,662,248	295,511	454,970	2,461,897
Illinois	5,171			3,545,138	770,576	2,354,151	6,675,036
Indiana	8,121		40,588	2,268,286	644,375	969,772	3,931,142

TABLE 9.—*Balances of funds available for programmed projects on June 30, 1939*—Continued

State	Public Works 1934–35	Works Program		Federal-aid system	Federal aid, secondary or feeder	Federal aid, grade crossings	Total
		Highways	Grade crossings				
Iowa			$5,344	$1,533,270	$1,657,792	$1,369,238	$4,565,644
Kansas		$48,583	35,366	4,195,785	1,353,173	1,075,292	6,708,199
Kentucky		6,645	101,779	3,017,531	317,903	1,107,615	4,551,473
Louisiana	$12,504	5,451	189,917	2,703,740	398,713	1,026,699	4,337,024
Maine	58	4,784	18,043	406,151	37,761	207,671	674,468
Maryland	7,970	45,811	117,424	1,824,539	388,839	993,901	3,378,493
Massachusetts	201,184	78,722	320,951	2,574,887	498,369	1,727,702	5,401,815
Michigan			2,968	3,145,182	967,350	2,085,059	6,200,559
Minnesota	7,668		4,818	3,815,595	1,202,621	1,537,428	6,568,130
Mississippi	10,304	15,533	25,138	2,824,715	798,585	934,587	4,608,922
Missouri	179,993	59,399	194,486	4,663,254	701,338	1,679,326	7,477,796
Montana	11,265	9,439	24,621	4,445,648	813,334	327,257	5,631,564
Nebraska	7,325	21,177	180,135	2,890,294	446,867	550,707	4,096,505
Nevada				1,603,560	192,987	112,509	1,909,056
New Hampshire		7,350	8,691	932,785	188,007	316,039	1,452,872
New Jersey	2,500	7,991	18,510	2,246,292	542,598	1,426,875	4,244,766
New Mexico	8,342	2,356	339	1,524,043	252,877	675,857	2,463,814
New York	6,020	210,887	591,843	4,110,959	851,452	4,288,723	10,059,884
North Carolina		3,680	20,283	2,112,429	349,602	990,495	3,476,489
North Dakota	2,306	1,215	59,108	3,430,254	875,949	369,188	4,738,020
Ohio		20,257	313,270	7,319,148	1,850,842	3,254,391	12,765,908
Oklahoma	928	13,953	91,268	3,841,245	973,691	2,191,397	7,112,480
Oregon	10,006	7,470	20,028	2,249,713	269,990	314,891	2,872,098
Pennsylvania	191,121	194,499	366,117	5,231,412	714,676	4,345,633	11,243,458
Rhode Island				1,073,748	134,171	152,439	1,360,378
South Carolina	10,591	8,337	128,957	2,408,179	279,791	959,865	3,795,720
South Dakota			16,304	3,427,465	1,050,410	1,110,539	5,604,718
Tennessee		24,877	215,024	4,604,324	881,548	1,373,250	7,099,323
Texas			432,602	7,136,819	1,160,749	2,208,513	10,938,683
Utah				1,076,602	209,198	217,372	1,503,172
Vermont			1,640	637,953	77,967	317,471	1,035,031
Virginia	15,892	11,789	100,026	1,066,943	367,303	912,147	2,474,100
Washington	821	621	35,150	1,080,604	266,006	502,865	1,886,067
West Virginia	21,652	38,386	47,138	2,263,331	515,848	964,852	3,851,207
Wisconsin			22,705	1,769,726	693,622	1,162,829	3,648,882
Wyoming	3,799		58,983	1,026,385	88,192	514,272	1,691,631
District of Columbia				338,750	73,125	128,186	540,061
Hawaii		313		1,058,510	223,510	360,830	1,643,163
Puerto Rico				482,540	82,069	426,676	991,285
Total	936,393	1,535,738	5,520,430	133,629,011	29,008,613	57,549,944	228,180,129

TABLE 10.—*Mileage of projects completed during the fiscal year 1939*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		1.3		234.3		235.6
Arizona				125.3		125.3
Arkansas		1.0	3.0	8.6	103.4	23.1	139.1
California					228.1	1.8	229.9
Colorado			2.9		134.3		137.2
Connecticut				.4	9.9		10.3
Delaware			.2	.3	17.1		17.6
Florida					82.4		82.4
Georgia		1.9	14.9	7.1	255.8	.6	280.3
Idaho					197.0	3.3	200.3
Illinois				.7	308.8	.6	310.1
Indiana		1.2			158.1	2.0	161.3
Iowa					271.1	2.5	273.6
Kansas					734.1	5.7	739.8
Kentucky				1.0	216.9		217.9
Louisiana				1.0	37.3		38.3
Maine				.4	69.9		70.3
Maryland		1.0	4.4		19.9		25.3
Massachusetts			.6	.1	11.1		11.8
Michigan				.3	157.3	.1	157.7
Minnesota					284.5		284.5

TABLE 10.—*Mileage of projects completed during the fiscal year 1939*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES—Continued

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Mississippi	2.6		0.9	251.3	0.2	255.0
Missouri				160.2	1.2	161.4
Montana			.4	102.8	10.2	113.4
Nebraska			1.6	404.2	8.9	414.7
Nevada				202.5	.9	203.4
New Hampshire				23.7	.6	24.3
New Jersey			.4	16.3		16.7
New Mexico				284.4	14.9	299.3
New York		0.2		253.5	2.1	255.8
North Carolina		.2	1.1	315.1	1.1	317.5
North Dakota	4.3			287.0		291.3
Ohio			2.2	100.5		102.7
Oklahoma		.4	.3	267.0		267.7
Oregon				152.9	.2	153.1
Pennsylvania			5.4	132.0	.7	138.1
Rhode Island				14.6		14.6
South Carolina	1.0		1.1	246.3	.1	248.5
South Dakota	13.0	4.4	.5	295.7	.6	314.2
Tennessee				199.9		199.9
Texas				1,115.9	15.4	1,131.3
Utah				123.2	1.1	124.3
Vermont				33.4	2.1	35.5
Virginia				249.1	1.4	250.5
Washington		.7	.5	112.4	1.5	115.1
West Virginia	.1		1.1	67.3	.7	69.2
Wisconsin	.1		.3	167.1	3.3	170.8
Wyoming	3.0	2.6		303.0	1.1	309.7
Hawaii		.6	.6	23.3		24.5
Puerto Rico				14.2	.4	14.6
Total	29.2	36.4	36.3	9,575.4	108.4	9,785.7

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama			1.0	12.3		13.3
Arizona				.3		.3
Arkansas			.4	3.7	1.4	5.5
California				28.3	.6	28.9
Colorado				4.8		4.8
Connecticut			.5	1.6		2.1
Delaware				.7		.7
Florida				1.0		1.0
Georgia	3.9	8.2	.1	25.4		37.6
Idaho				1.2	.3	1.5
Illinois	.4		.8	21.3	.3	22.8
Indiana	.6			5.2		5.8
Iowa		.3	.5	18.8	.7	20.3
Kansas		.8	1.2	23.5	.6	26.1
Kentucky	1.1	1.2	.6	5.9	.4	9.2
Louisiana			.4	.9		1.3
Maine				1.3		1.3
Maryland	1.2					1.2
Massachusetts				5.1	.1	5.2
Michigan		.3	.1	16.8		17.2
Minnesota	.2		.3	33.4		33.9
Mississippi	.6	2.6	.4	32.8	.2	36.6
Missouri		.2	.1	5.2	.9	6.4
Montana		.1		.9	.5	1.5
Nebraska		2.8	.3	9.7		12.8
New Hampshire				1.9		1.9
New Jersey	.7			3.7		4.4
New Mexico				10.5		10.5
New York	1.0	.2	.2	19.6		21.0
North Carolina				21.6	.2	21.8
North Dakota	.8	28.5		5.5	.1	34.9
Ohio		.6	1.0	11.8		13.4
Oklahoma			.1	5.8		5.9
Oregon	.2			6.1	1.0	7.3
Pennsylvania	.2	3.3	2.0	12.2		17.7
Rhode Island				3.3		3.3
South Carolina	.4	2.2	.7	20.8	.4	24.5
South Dakota	.8	12.9	1.5	4.8		20.0
Tennessee				7.5		7.5

TABLE 10.—*Mileage of projects completed during the fiscal year 1939*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES—Continued

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Texas	0.5	2.9		40.6		44.0
Utah				9.9		9.9
Vermont				.5		.5
Virginia	.3	.2	1.2	6.7	1.0	9.4
Washington				1.9		1.9
West Virginia			.2	4.0	.9	5.1
Wisconsin				21.8		21.8
Wyoming	.6		.5	1.3		2.4
Total	13.5	67.3	14.1	481.9	9.6	586.4

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Secondary or feeder	Grade crossings	
		Miles	*Miles*	*Miles*	*Miles*	*Miles*
Alabama				0.7	0.2	0.9
Arkansas				.9	.1	1.0
California					.3	.3
Colorado			0.3	1.9		2.2
Connecticut				.3		.3
Georgia		10.5	1.4	2.7		14.6
Idaho				.4		.4
Illinois		.8	.3	17.8		18.9
Indiana				.3		.3
Kansas				.9		.9
Kentucky		.5	.1	.4		1.0
Louisiana			.7			.7
Maine				2.4		2.4
Maryland			.4			.4
Massachusetts				.1	.1	.2
Minnesota					.1	.1
Mississippi		1.5	.1			1.6
Missouri			.3	1.5		1.8
Montana			.1			.1
Nebraska		1.4	.6	2.3		4.3
New Jersey			.3		.2	.5
New Mexico					.2	.2
New York		.1	.7	1.1	.1	2.0
North Carolina		.5	.4	13.1	.6	14.6
North Dakota			.1	1.5	.1	1.7
Ohio		1.0	.4			1.4
Oklahoma		4.0	.4	1.3		5.7
Oregon				.6		.6
Pennsylvania		5.8	.4	1.6		7.8
South Carolina		8.9	.9	1.7	.5	12.0
South Dakota			.4			.4
Tennessee		2.0	.8			2.8
Texas		6.1		13.5	1.8	21.4
Utah				6.6		6.6
Vermont				1.4		1.4
Virginia				.4	.1	.5
Washington				2.3	.6	2.9
West Virginia			.6		.3	.9
Wisconsin			.3	2.1		2.4
Wyoming				.6		.6
District of Columbia					.2	.2
Total		43.1	10.0	80.4	5.5	139.0

TABLE 10.—*Mileage of projects completed during the fiscal year 1939*—Continued

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		6.5	0.1	23.6	1.9	32.1
Arizona				42.3		42.3
Arkansas				9.1		9.1
California				117.8		117.8
Colorado		6.0		62.9	.3	69.2
Connecticut			.6	1.3		1.9
Delaware				5.3		5.3
Florida			.5			.5
Georgia	7.0	63.1	2.8	67.4		140.3
Idaho			.6	56.8		57.4
Illinois	7.1	28.4	.2	149.7		185.4
Indiana			.4	80.2	1.0	81.6
Kansas		10.3		29.0		39.3
Kentucky		2.3		105.8		108.1
Louisiana	6.9			20.0		26.9
Maine		.8		23.3	1.6	25.7
Maryland	4.3	6.1	.9			11.3
Massachusetts		.4	.5	1.8		2.7
Michigan		3.3		37.5		40.8
Minnesota				42.2		42.2
Missouri				71.3		71.3
Montana	3.4	4.4				7.8
Nebraska		5.9		99.0		104.9
Nevada				68.8		68.8
New Hampshire		5.6		6.1		11.7
New Jersey			.9	2.5		3.4
New Mexico				57.5	.5	58.0
New York	.2	1.0	.1	166.7	.9	168.9
North Carolina		4.9	.9	76.1	.2	82.1
North Dakota	4.0	16.2		25.3		45.5
Ohio		2.2	1.5	3.7		7.4
Oklahoma	.2	1.6		40.9		42.7
Oregon	.2			62.6		62.8
Pennsylvania	1.0	6.6	.3	131.9	.4	140.2
Rhode Island				7.2		7.2
South Carolina	7.7	8.8		77.3		93.8
South Dakota	6.2	.4	17.4		2.8	26.8
Tennessee	.4	9.1		17.6		27.1
Texas	.2	8.6		501.6	2.9	513.3
Utah				59.3		59.3
Vermont				12.4	.8	13.2
Virginia	15.5	8.9		90.5	5.1	120.0
Washington			.5	61.9	2.0	64.4
West Virginia	10.5			21.4		31.9
Wisconsin				26.7		26.7
Wyoming				58.4		58.4
Puerto Rico				13.7		13.7
Total	74.8	211.4	28.2	2,636.4	20.4	2,971.2

TOTAL

State	Public Works, 1934–35	Works Program		Federal aid			Total
		Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		7.8	1.1	246.6	24.3	2.1	281.9
Arizona				125.6	42.3		167.9
Arkansas	1.0	3.0	8.9	107.2	9.9	24.7	154.7
California				256.3	117.9	2.7	376.9
Colorado		9.0	.3	139.0	64.8	.3	213.4
Connecticut			1.5	11.5	1.6		14.6
Delaware		.2	.3	17.8	5.3		23.6
Florida			.5	83.4			83.9
Georgia	12.8	96.7	11.4	281.2	70.1	.6	472.8
Idaho			.6	198.2	57.2	3.6	259.6
Illinois	7.5	29.2	2.0	330.2	167.4	.9	537.2
Indiana	1.9		.4	163.3	80.5	2.9	249.0

TABLE 10.—*Mileage of projects completed during the fiscal year 1939*—Continued

TOTAL—Continued

State	Public Works, 1934–35	Works Program		Federal aid			Total
		Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Iowa		0.3	0.5	290.0		3.1	293.9
Kansas		11.0	1.2	757.6	29.9	6.4	806.1
Kentucky	1.1	4.0	1.8	222.8	106.1	.4	336.2
Louisiana	6.9		2.0	38.3	20.0		67.2
Maine		.8	.4	71.2	25.7	1.6	99.7
Maryland	6.5	10.5	1.3	19.9			38.2
Massachusetts		1.0	.6	16.3	1.8	.2	19.9
Michigan		3.7	.4	174.1	37.4	.1	215.7
Minnesota	.2		.3	317.9	42.2	.1	360.7
Mississippi	3.2	4.1	1.4	284.1		.4	293.2
Missouri		.2	.4	165.5	72.8	2.0	240.9
Montana	3.4	4.4	.5	103.7		10.8	122.8
Nebraska		10.2	2.5	413.9	101.3	8.8	536.7
Nevada				202.5	68.8	.9	272.2
New Hampshire		5.6		25.7	6.0	.6	37.9
New Jersey	.7		1.6	20.0	2.5	.2	25.0
New Mexico				294.9	57.5	15.6	368.0
New York	1.1	1.5	1.0	273.1	167.9	3.1	447.7
North Carolina		5.6	2.3	336.7	89.3	2.1	436.0
North Dakota	9.2	44.8	.1	292.3	26.8	.2	373.4
Ohio		3.7	5.1	112.3	3.8		124.9
Oklahoma	.2	6.1	.9	272.7	42.1		322.0
Oregon	.4			159.0	63.2	1.2	223.8
Pennsylvania	1.2	15.6	8.1	144.2	133.5	1.2	303.8
Rhode Island				17.9	7.2		25.1
South Carolina	8.9	19.9	2.7	267.1	79.1	1.1	378.8
South Dakota	20.0	17.7	19.7	300.6		3.4	361.4
Tennessee	.4	11.1	.8	207.4	17.6		237.3
Texas	.7	17.5		1,156.4	515.2	20.2	1,710.0
Utah				133.1	65.9	1.1	200.1
Vermont				33.9	13.8	2.9	50.6
Virginia	15.8	9.1	1.3	255.8	90.8	7.6	380.4
Washington		.7	1.1	114.2	64.3	4.0	184.3
West Virginia	10.7		1.9	71.3	21.4	1.8	107.1
Wisconsin	.1		.6	188.8	28.9	3.3	221.7
Wyoming	3.6	2.6	.5	304.3	59.0	1.1	371.1
Hawaii		.6	.6	23.3			24.5
District of Columbia						.2	.2
Puerto Rico				14.2	13.7	.4	28.3
Total	117.5	358.2	88.6	10,057.3	2,716.8	143.9	13,482.3

TABLE 11.—*Mileage of projects under contract on June 30, 1939*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama				301.9	0.2	302.1
Arizona				60.1	3.1	63.2
Arkansas				211.2	5.2	216.4
California				66.0	.9	66.9
Colorado				89.2	.4	89.6
Connecticut				15.7		15.7
Delaware				11.8		11.8
Florida				39.3		39.3
Georgia	0.8	0.1	1.6	316.5	6.3	325.3
Idaho				53.0	4.0	57.0
Illinois			.4	213.7	4.0	218.1
Indiana		.1		131.6	1.2	132.9
Iowa		.1	1.1	182.6	.4	184.2
Kansas				172.1	5.3	177.4
Kentucky				98.6	3.5	102.1
Louisiana			.5	57.4	13.8	71.7

TABLE 11.—*Mileage of projects under contract on June 30, 1939*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES—Continued

State	Public Works, 1934-35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Maine	0.1			29.2	4.9	34.2
Maryland	1.1	1.8	0.5	53.7		57.1
Massachusetts				20.8	1.6	22.4
Michigan			.6	139.1	6.2	145.9
Minnesota			.4	341.7	.6	342.7
Mississippi				320.4	1.2	321.6
Missouri				214.0	1.1	215.1
Montana				188.7	4.8	193.5
Nebraska		.8	.6	450.2	12.7	464.3
Nevada				44.5	1.4	45.9
New Hampshire				31.2	.5	31.7
New Jersey				22.1		22.1
New Mexico				121.9		121.9
New York	1.1	1.4		204.2	5.6	212.3
North Carolina				383.2	2.2	385.4
North Dakota	.1		9.7	27.8	3.2	40.8
Ohio				112.4	2.5	114.9
Oklahoma			.3	28.7	2.4	31.4
Oregon			.1	125.1	.5	125.7
Pennsylvania	1.0			103.0	.6	104.6
Rhode Island				11.0	.3	11.3
South Carolina			1.3	84.5	.8	86.6
South Dakota				413.4	6.8	420.2
Tennessee				102.5		102.5
Texas				617.6	21.0	638.6
Utah				89.2		89.2
Vermont				22.4		22.4
Virginia				73.6	2.7	76.3
Washington				34.4	1.6	36.0
West Virginia				47.7	.7	48.4
Wisconsin				262.7	1.9	264.6
Wyoming				147.5	.5	148.0
Hawaii	1.8			10.3	2.2	14.3
Puerto Rico				35.2	1.3	36.5
Total	6.0	4.3	17.1	6,934.6	140.1	7,102.1

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama	1.5			23.8	0.6	25.9
Arkansas				10.0		10.0
California			0.1	1.2	.4	1.7
Colorado				5.0	.3	5.3
Delaware				1.0		1.0
Florida				2.8	.2	3.0
Georgia	1.3	4.6	.7	34.8	.7	42.1
Idaho				2.3	.4	2.7
Illinois	1.5		.4	17.4	1.7	21.0
Indiana		1.1		4.7		5.8
Iowa			2.3	12.3	1.1	15.7
Kansas		.2		1.8	1.2	3.2
Kentucky				3.2	1.1	4.3
Louisiana			5.6	1.5	2.1	9.2
Maine				.1	.4	.5
Maryland		1.7		.2		1.9
Massachusetts				4.2	.2	4.4
Michigan				15.7	1.4	17.1
Minnesota				29.4	.7	30.1
Mississippi		.3		8.4	1.3	10.0
Missouri		.4		7.1	1.0	8.5
Montana				6.5	.7	7.2
Nebraska				10.1	1.4	11.5
Nevada				.8		.8
New Hampshire				.2		.2
New Jersey				7.9	.1	8.0
New Mexico				.3		.3
New York				5.4	.5	5.9
North Carolina				12.6	4.9	17.5
North Dakota	.5			.7	.9	2.1
Ohio			.4	3.7	.4	4.5

TABLE 11.—*Mileage of projects under contract on June 30, 1939*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES—Continued

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Oklahoma				1.0		1.0
Oregon				2.9	0.4	3.3
Pennsylvania				13.7	1.0	14.7
Rhode Island				3.1	.5	3.6
South Carolina			0.2	2.0	.7	2.9
South Dakota				5.3		5.3
Tennessee				10.3	.4	10.7
Texas			.6	14.5	5.4	20.5
Utah				16.2		16.2
Virginia	0.2			2.3		2.5
Washington				1.5		1.5
West Virginia	2.3			3.7		6.0
Wisconsin				45.0	.2	45.2
Wyoming				1.0		1.0
Hawaii				2.5		2.5
Total	7.3	8.3	10.3	360.1	32.3	418.3

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

State	Public Works 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Secondary or feeder	Grade crossings	
		Miles	*Miles*	*Miles*	*Miles*	*Miles*
Alabama				2.6	1.5	4.1
Arizona					.2	.2
Arkansas				1.7		1.7
California					.7	.7
Colorado				.1	1.0	1.1
Delaware				.3	.3	.6
Florida				.4	.4	.8
Georgia		0.7	1.4	5.0	.4	7.5
Illinois		1.0	.2	3.1	.2	4.5
Indiana				.1		.1
Iowa				.4		.4
Kansas				.1	.2	.3
Kentucky				.2		.2
Maryland		.2		.1		.3
Michigan				3.0		3.0
Minnesota				2.2	1.9	4.1
Missouri				1.8		1.8
Montana					.2	.2
Nebraska				3.5	.8	4.3
New Jersey		.2				.2
New York					.1	.1
North Carolina			1.8	3.2		5.0
North Dakota					.6	.6
Ohio			.8	.6	.5	1.9
Oregon				2.9	.1	3.0
Pennsylvania				.8	.6	1.4
South Carolina		.7	.3	3.0	.9	4.9
South Dakota			1.0		.2	1.2
Tennessee				.3	.3	.6
Texas		.4		11.3	.9	12.6
Utah		1.8		2.3		4.1
Virginia		1.4			.1	1.5
Washington				1.8		1.8
Wisconsin				1.1	1.1	2.2
Wyoming				1.1		1.1
Total		6.4	5.5	53.0	13.2	78.1

TABLE 11.—*Mileage of projects under contract on June 30, 1939*—Continued

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

State	Public Works 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama				30.5	1.9	32.4
Arizona				29.4		29.4
Arkansas				71.8		71.8
California				44.7	1.9	46.6
Colorado		6.4		24.2		30.6
Connecticut				2.9		2.9
Delaware				17.3	.3	17.6
Florida				37.2		37.2
Georgia	4.6	23.9	6.0	51.5	.5	86.5
Idaho				11.2		11.2
Illinois	6.9			90.8	.3	98.0
Indiana				80.5	3.5	84.0
Iowa				34.9	.9	35.8
Kansas				17.6		17.6
Kentucky				87.5	2.6	90.1
Louisiana		10.4		59.9		70.3
Maine		1.1		13.3	.2	14.6
Maryland	1.9	3.5	1.4	17.6		24.4
Massachusetts				9.2		9.2
Michigan				78.6		78.6
Minnesota	1.5			60.2	.5	62.2
Mississippi	5.2			61.3		66.5
Missouri				119.4	.2	119.6
Montana				58.2		58.2
Nebraska				140.3	.6	140.9
Nevada				15.5		15.5
New Hampshire				2.4	.9	3.3
New Jersey	1.9			12.4	.6	14.9
New Mexico				28.1	1.0	29.1
New York		4.1		106.4	.8	111.3
North Carolina				115.8	.4	116.2
North Dakota				8.3	.3	8.6
Ohio		8.9		36.5	.7	46.1
Oklahoma				.8	.5	1.3
Oregon			.1	69.4		69.5
Pennsylvania				115.5		115.5
Rhode Island				2.2		2.2
South Carolina	1.4	4.4		53.9	5.9	65.6
South Dakota	4.8	4.7			1.0	10.5
Tennessee			.6	31.7		32.3
Texas		8.0		207.8	3.7	219.5
Utah				24.9		24.9
Vermont				4.5		4.5
Virginia			.3	57.8	.1	58.2
Washington				38.4		38.4
West Virginia		4.3	.5	8.4	.9	14.1
Wisconsin			.6	31.6	3.7	35.9
Wyoming				22.9		22.9
Hawaii				4.6		4.6
Puerto Rico				12.5		12.5
Total	28.2	79.7	9.5	2,262.3	33.9	2,413.6

TOTAL

State	Public Works, 1934–35	Works Program		Federal aid			Total
		High-ways	Grade cross-ings	High-ways	Second-ary or feeder	Grade cross-ings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama	1.5			325.8	33.1	4.1	364.5
Arizona				60.3	29.3	3.2	92.8
Arkansas				221.2	73.5	5.2	299.9
California			0.1	67.2	44.7	3.9	115.9
Colorado		6.4		94.2	24.3	1.7	126.6
Connecticut				15.7	2.9		18.6
Delaware				12.8	17.5	.7	31.0
Florida				42.1	37.6	.6	80.3

TABLE 11.—*Mileage of projects under contract on June 30, 1939*—Continued

TOTAL—Continued

State	Public Works, 1934–35	Works Program		Federal aid			Total
		Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Georgia	6.7	29.4	9.5	351.1	56.7	8.0	461.4
Idaho				55.3	11.2	4.4	70.9
Illinois	8.4	1.0	1.1	231.1	93.8	6.2	341.6
Indiana		1.2		136.4	80.5	4.7	222.8
Iowa		.1	3.4	194.8	35.4	2.4	236.1
Kansas		.2		173.9	17.7	6.7	198.5
Kentucky				101.9	87.7	7.1	196.7
Louisiana		10.4	6.1	58.6	60.0	16.1	151.2
Maine	.1	1.1		29.4	13.4	5.3	49.3
Maryland	3.0	7.1	2.0	53.9	17.7		83.7
Massachusetts				25.0	9.2	1.8	36.0
Michigan			.6	154.7	81.6	7.7	244.6
Minnesota	1.5		.4	371.1	62.5	3.6	439.1
Mississippi	5.2	.3		328.7	61.4	2.5	398.1
Missouri		.4		221.2	121.1	2.3	345.0
Montana				195.2	58.2	5.7	259.1
Nebraska		.8	.6	460.2	143.8	15.6	621.0
Nevada				45.3	15.5	1.4	62.2
New Hampshire				31.4	2.4	1.4	35.2
New Jersey	1.9	.2		29.9	12.5	.7	45.2
New Mexico				122.2	28.1	1.0	151.3
New York	1.1	5.5		209.7	106.4	6.9	329.6
North Carolina			1.8	395.8	119.0	7.5	524.1
North Dakota	.6		9.7	28.6	8.3	4.9	52.1
Ohio		8.9	1.2	116.1	37.1	4.1	167.4
Oklahoma			.3	29.7	.8	2.9	33.7
Oregon			.1	128.0	72.3	1.1	201.5
Pennsylvania	1.0			116.8	116.3	2.1	236.2
Rhode Island				14.1	2.2	.8	17.1
South Carolina	1.4	5.1	1.9	86.3	56.9	8.4	160.0
South Dakota	4.8	4.7	1.0	418.7		8.0	437.2
Tennessee			.6	112.8	32.0	.7	146.1
Texas		8.4	.6	632.1	219.0	31.1	891.2
Utah		1.8		105.4	27.2		134.4
Vermont				22.4	4.5		26.9
Virginia	.2	1.4	.3	75.9	57.8	2.9	138.5
Washington				36.0	40.1	1.6	77.7
West Virginia	2.3	4.3	.5	51.5	8.3	1.6	68.5
Wisconsin			.6	307.7	32.7	6.9	347.9
Wyoming				148.5	24.0	.5	173.0
Hawaii	1.8			12.8	4.6	2.2	21.4
Puerto Rico				35.2	12.5	1.3	49.0
Total	41.5	98.7	42.4	7,294.7	2,315.3	219.5	10,012.1

TABLE 12.—*Mileage of projects approved but not under contract on June 30, 1939*

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama			0.1	4.6		4.7
Arizona				10.1		10.1
Arkansas				1.8		1.8
California				4.5		4.5
Colorado				2.8		2.8
Connecticut				4.1	0.6	4.7
Delaware				24.9		24.9
Florida				29.5		29.5
Georgia				108.8		108.8
Illinois				24.6	2.0	26.6
Indiana				39.1	.3	39.4
Iowa				35.8		35.8
Kansas				192.0	4.8	196.8
Kentucky				51.5	.8	52.3
Louisiana				20.3		20.3
Maine				28.1	.5	28.6

TABLE 12.—*Mileage of projects approved but not under contract on June 30, 1939*—Continued

ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES—Continued

State	Public Works, 1934–35	Works Program		Federal aid		Total
		Highways	Grade crossings	Highways	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Maryland				12.6		12.6
Massachusetts				5.9		5.9
Michigan				23.6	0.5	24.1
Minnesota				104.6		104.6
Mississippi				39.8		39.8
Missouri				43.7	.8	44.5
Nebraska				287.0	.9	287.9
New Hampshire				12.4		12.4
New Jersey				1.5		1.5
New York				21.0	.4	21.4
North Carolina				57.3		57.3
North Dakota	14.1			316.9		331.0
Ohio				12.9	.4	13.3
Oklahoma				87.7		87.7
Pennsylvania				3.3		3.3
South Carolina				22.2		22.2
South Dakota				128.1		128.1
Tennessee				8.4		8.4
Texas				49.0	.5	49.5
Utah				10.5		10.5
Vermont				.6		.6
Virginia	.3			35.9	.4	36.6
Washington				10.0		10.0
West Virginia				29.1		29.1
Wisconsin				22.2		22.2
Wyoming				37.7		37.7
Hawaii		0.1		13.7		13.8
District of Columbia				2.0		2.0
Puerto Rico				.5		.5
Total	14.4	.1	0.1	1,982.6	12.9	2,010.1

ON THE FEDERAL-AID HIGHWAY SYSTEM IN MUNICIPALITIES

	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Arkansas				1.4		1.4
California			0.2	1.8		2.0
Connecticut				1.5		1.5
Delaware				.7		.7
Florida				1.8	0.4	2.2
Georgia	0.6			46.0		46.6
Illinois	.2			4.8		5.0
Indiana				1.5	.6	2.1
Iowa				9.7		9.7
Kansas				8.4	.7	9.1
Kentucky				1.0	.2	1.2
Louisiana				1.3		1.3
Maine				3.2		3.2
Maryland				.3		.3
Massachusetts				4.4		4.4
Michigan				.3		.3
Minnesota				5.1	.2	5.3
Mississippi				2.0		2.0
Missouri				1.5	.5	2.0
Nebraska				6.3		6.3
New York				.9	.6	1.5
North Carolina				2.1		2.1
North Dakota		0.5		3.7		4.2
Ohio				.5		.5
Oklahoma				5.6	.5	6.1
South Carolina				1.5	.2	1.7
South Dakota	.7			3.2		3.9
Texas				.8	1.0	1.8
Utah				.3		.3
Virginia				3.2	.3	3.5
Washington				.3		.3
West Virginia				1.0		1.0
Wyoming				.2		.2
Hawaii				.7		.7
District of Columbia					.1	.1
Total	1.5	.5	.2	127.0	5.3	134.5

TABLE 12.—*Mileage of projects approved but not under contract on June 30, 1939*—Continued

ON SECONDARY OR FEEDER ROADS IN MUNICIPALITIES

State	Public Works 1934–35	Works Program, grade crossings	Federal aid		Total
			Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*
Delaware			0.4		0.4
Georgia			1.1	1.0	2.1
Illinois			.6		.6
Louisiana			5.5		5.5
Minnesota			.8		.8
Missouri			.8		.8
Montana			.9		.9
Nebraska		0.5	.6	.2	1.3
New York				.8	.8
North Carolina			.7	.6	1.3
North Dakota				.1	.1
Ohio				.4	.4
Oklahoma			.5		.5
Tennessee				.3	.3
Texas				.5	.5
Utah				.1	.1
Virginia				.1	.1
Washington			1.2	.1	1.3
Wisconsin			.1		.1
Total		.5	13.2	4.2	17.9

ON SECONDARY OR FEEDER ROADS OUTSIDE OF MUNICIPALITIES

	Miles	*Miles*	*Miles*	*Miles*	*Miles*
Arizona	0.7				0.7
Arkansas			4.1		4.1
California			3.7		3.7
Colorado			1.4		1.4
Delaware		4.5	7.4		11.9
Georgia	.2		17.8		18.0
Illinois			12.1		12.1
Indiana			22.5		22.5
Iowa				2.3	2.3
Kansas			15.8		15.8
Kentucky			45.5		45.5
Louisiana			15.5	1.0	16.5
Maine			12.4		12.4
Maryland			7.6		7.6
Massachusetts			3.2		3.2
Michigan			29.6		29.6
Minnesota			14.6		14.6
Missouri			42.0		42.0
Montana			16.9		16.9
Nebraska			66.5		66.5
Nevada			9.5		9.5
New Hampshire				.8	.8
New Jersey			7.4	.9	8.3
New York			5.7		5.7
North Carolina			9.6		9.6
North Dakota			8.2		8.2
Ohio			8.3	.6	8.9
Oklahoma			36.9	1.2	38.1
Oregon			3.3		3.3
Pennsylvania			7.5	1.1	8.6
South Carolina			12.3		12.3
Tennessee				.3	.3
Texas			27.1		27.1
Utah			8.2		8.2
Vermont			2.6		2.6
Virginia			8.2		8.2
Washington			15.1		15.1
West Virginia				.3	.3
Wisconsin			3.7		3.7
Wyoming			27.9		27.9
Hawaii			1.3		1.3
Total	.9	4.5	541.4	8.5	555.3

TABLE 12.—*Mileage of projects approved but not under contract on June 30, 1939*—Continued

TOTAL

State	Public Works, 1934-35	Works Program		Federal aid			Total
		Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama			0.1	4.6			4.7
Arizona	0.7			10.1			10.8
Arkansas				3.2	4.1		7.3
California			.2	6.3	3.7		10.2
Colorado				2.8	1.4		4.2
Connecticut				5.6		0.6	6.2
Delaware		4.5		25.6	7.8		37.9
Florida				31.3		.4	31.7
Georgia	.8			154.8	18.9	1.0	175.5
Illinois	.2			29.3	12.8	2.0	44.3
Indiana				40.6	22.5	.9	64.0
Iowa				45.5		2.3	47.8
Kansas				200.6	15.8	5.3	221.7
Kentucky				52.6	45.5	.9	99.0
Louisiana				21.6	21.0	1.0	43.6
Maine				31.3	12.4	.5	44.2
Maryland				12.9	7.6		20.5
Massachusetts				10.3	3.2		13.5
Michigan				23.9	29.6	.5	54.0
Minnesota				109.7	15.4	.2	125.3
Mississippi				41.8			41.8
Missouri				45.2	42.8	1.3	89.3
Montana					17.8		17.8
Nebraska			.5	293.3	67.0	1.2	362.0
Nevada					9.5		9.5
New Hampshire				12.4		.8	13.2
New Jersey				1.5	7.4	.9	9.8
New York				22.0	5.7	1.7	29.4
North Carolina				59.3	10.4	.6	70.3
North Dakota	14.1	.5		320.6	8.2	.1	343.5
Ohio				13.4	8.3	1.4	23.1
Oklahoma				93.3	37.3	1.8	132.4
Oregon					3.3		3.3
Pennsylvania				3.3	7.5	1.1	11.9
South Carolina				23.7	12.3	.2	36.2
South Dakota	.7			131.3			132.0
Tennessee				8.3		.7	9.0
Texas				49.7	27.1	2.1	78.9
Utah				10.8	8.2	.1	19.1
Vermont				.6	2.6		3.2
Virginia	.3			39.1	8.2	.8	48.4
Washington				10.3	16.3	.1	26.7
West Virginia				30.1		.3	30.4
Wisconsin				22.2	3.8		26.0
Wyoming				37.9	27.9		65.8
Hawaii		.1		14.4	1.3		15.8
District of Columbia				2.0		.1	2.1
Puerto Rico				.5			.5
Total	16.8	5.1	.8	2,109.6	554.6	30.9	2,717.8

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TABLE 13.—*Status of grade-crossing elimination and protection projects on June 30, 1939*

COMPLETED DURING FISCAL YEAR

State	Crossings eliminated						Separation structures reconstructed			Crossings protected						
	Public Works, 1934–35	Works Program		Federal aid		Total	Works Program grade crossings	Federal-aid grade crossings	Total	Public Works, 1934–35	Works Program		Federal aid			Total
		Highways	Grade crossings	Highways	Grade crossings						Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings	
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Alabama			4		7	11									6	6
Arkansas			5		14	19						2				2
California				1	5	6		3	3	15						15
Colorado			3		2	5									6	6
Connecticut			4			4										
Delaware			2			2									23	23
Florida			1		1	2						45				45
Georgia	1		18		1	20	11		11			14				14
Idaho			1		5	6						1				1
Illinois	1		11	2	4	18							1	1	22	24
Indiana			1		4	5		4	4			32			21	53
Iowa					13	13		2	2						20	20
Kansas			5		6	11	1		1						5	5
Kentucky			3	1	1	5	3		3	5					31	36
Louisiana			4		1	5	1		1				1			1
Maine			1		2	3									1	1
Maryland			4			4						14				14
Massachusetts		1	2	3		6		2	2							
Michigan			1		8	9	1	1	2						45	45
Minnesota			2			2		1	1				1		3	4
Mississippi			5		4	9	1		1	1		3				4
Missouri			5		4	9		1	1							
Montana			1		4	5	2		2							
Nebraska			3		8	11										
Nevada				1	1	2		3	3			2			6	8
New Hampshire								1	1			1			2	3
New Jersey			3	1	2	6	3	1	4						1	1
New Mexico					7	7		1	1			1				1
New York			7		5	12	2	4	6						3	3
North Carolina			4		3	7	1	4	5						8	8
North Dakota					1	1	1	1	2							
Ohio			23			23						1				1
Oklahoma			2			2									5	5

TABLE 13.—*Status of grade-crossing elimination and protection projects on June 30, 1939*—Continued

COMPLETED DURING FISCAL YEAR—Continued

State	Crossings eliminated						Separation structures reconstructed			Crossings protected						
	Public Works, 1934–35	Works Program		Federal aid		Total	Works Program grade crossings	Federal-aid grade crossings	Total	Public Works, 1934–35	Works Program		Federal aid			Total
		Highways	Grade crossings	Highways	Grade crossings						Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings	
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Oregon					3	3		2	2							
Pennsylvania			15	1	2	18	5		5							
South Carolina			4		11	15	4	1	5			5			4	9
South Dakota			5		4	9						5			9	14
Tennessee			3			3	1	1	2			1			6	7
Texas			1	1	17	19		3	3		1	2				3
Utah					2	2									4	4
Vermont					6	6		2	2						8	8
Virginia			4		17	21		3	3			1			7	8
Washington			2	2	9	13		4	4						3	3
West Virginia			10		1	11						1			5	6
Wisconsin			1	2	3	6	1		1			23				23
Wyoming			1			1		2	2						4	4
Hawaii			2		1	3										
District of Columbia								1	1							
Puerto Rico					2	2										
Total	2	1	173	15	191	382	38	48	86	21	1	154	3	1	258	438

UNDER CONTRACT

State	Crossings eliminated							Separation structures reconstructed			Crossings protected				
	Public Works 1934–35	Works Program		Federal aid			Total	Works Program grade crossings	Federal aid grade crossings	Total	Public Works 1934–35	Works Program grade crossings	Federal aid		Total
		Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings							Highways	Grade crossings	
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Alabama			2			15	17		1	1				1	1
Arizona						5	5					2			2
Arkansas						4	4							4	4
California			2	1		11	14				39	8			47
Colorado						4	4					4		25	29
Delaware						2	2							1	1
Florida				1		2	3					12		1	13
Georgia			13			7	20	4		4		23		9	32
Idaho						4	4								
Illinois			4	7		18	29		3	3			2	67	69
Indiana						3	3		1	1			2	78	80
Iowa			12			9	21							89	89
Kansas						11	11							8	8
Kentucky						10	10		4	4					
Louisiana			3	1		13	17								
Maine						4	4		3	3					
Maryland	1		8			1	10					1		14	15
Massachusetts						4	4		2	2					
Michigan			1			6	7		2	2				20	20
Minnesota			3	1	1	5	10	1	6	7				11	11
Mississippi			1			8	9					4			4
Missouri		1				7	8		1	1					
Montana						10	10								
Nebraska			1	1		24	26					3		35	38
Nevada			1			1	2		1	1				11	11
New Hampshire						7	7							1	1
New Jersey				2		1	3		2	2				1	1
New Mexico						2	2							1	1
New York						4	4		10	10					
North Carolina			8			8	16	1	5	6		115		43	158
North Dakota			4			11	15		1	1					
Ohio			10	1		11	22		1	1				2	2
Oklahoma				1		2	3	1		1		1		50	51
Oregon			1			3	4	1		1					
Pennsylvania				3		3	6		3	3				2	2

TABLE 13.—*Status of grade-crossing elimination and protection projects on June 30, 1939*—Continued

UNDER CONTRACT—Continued

State	Crossings eliminated							Separation structures reconstructed			Crossings protected				
	Public Works, 1934-35	Works Program		Federal aid			Total	Works Program grade crossings	Federal aid grade crossings	Total	Public Works, 1934-35	Works Program grade crossings	Federal aid		Total
		Highways	Grade crossings	Highways	Secondary or feeder	Grade crossings							Highways	Grade crossings	
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Rhode Island						1	1		3	3					
South Carolina	1		2			8	11	2	2	4				35	35
South Dakota			11			3	14		2	2		10		17	27
Tennessee			2			2	4		2	2		3		5	8
Texas			1			24	25		3	3		2		6	8
Utah						2	2							127	127
Vermont														7	7
Virginia		1	1			8	10		2	2	1			17	18
Washington						3	3							12	12
West Virginia			2	2		7	11							1	1
Wisconsin				7		15	22	1	2	3		3		4	7
Wyoming						1	1		1	1				7	7
Hawaii						4	4		1	1					
Puerto Rico						9	9								
Total	2	2	93	28	1	327	453	11	64	75	40	191	4	712	947

APPROVED BUT NOT UNDER CONTRACT

State	Crossings eliminated				Separation structures reconstructed		
	Works Program grade crossings	Federal aid		Total	Works Program grade crossings	Federal-aid grade crossings	Total
		Highways	Grade crossings				
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Alabama			1	1	1		1
California	5			5			
Connecticut						1	1
Delaware		2		2			
Florida			1	1			
Georgia			1	1		2	2
Illinois		1	2	3			
Indiana			2	2		1	1
Iowa			5	5			
Kansas			5	5			
Kentucky			1	1	1	1	2
Louisiana			2	2			
Maine			1	1			
Maryland			1	1			
Massachusetts		1		1			
Michigan		1		1			
Minnesota			3	3			
Missouri			2	2		2	2
Nebraska			4	4			
New Hampshire			2	2			
New Jersey			1	1		1	1
New York			6	6		1	1
North Carolina			4	4			
North Dakota			2	2			
Ohio			5	5		1	1
Oklahoma			3	3			
Pennsylvania			3	3			
South Carolina						1	1
Tennessee			1	1		1	1
Texas			3	3			
Utah			1	1			
Virginia			1	1		1	1
Washington						2	2
West Virginia			1	1			
District of Columbia			1	1			
Total	5	5	65	75	2	15	17

TABLE 14.—*Mileage, by types of construction, of projects completed during the fiscal year 1939*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Grade separations		Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							Railroad and highways	Between highways	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama		1.1	163.2	7.7	106.9						0.1		2.6	0.3		281.9
Arizona				11.0	72.6			79.7			3.5		1.1			167.9
Arkansas	27.6		1.9	17.6				76.9			29.9		.3	.5		154.7
California	18.4		1.0	11.5	37.4			141.8	14.7	89.4	58.8		3.3	.6		376.9
Colorado				211.2						.3	.4		1.1	.4		213.4
Connecticut					.3		2.6		2.5		9.0			.2		14.6
Delaware				5.3						1.7	16.3		.1	.2		23.6
Florida	39.9				6.2		6.9	1.3			28.6		1.0			83.9
Georgia	2.6	51.7	68.4	60.4	129.4		80.9			16.3	60.1		2.3	.7		472.8
Idaho	7.8			78.2				168.3		.1	4.9		.2	.1		259.6
Illinois	142.9	5.0		38.2	3.8	172.7	9.2	40.1		5.3	113.8	1.5	4.2	.5		537.2
Indiana	30.7			37.7				39.7		37.0	102.9		.7	.3		249.0
Iowa	51.2			.6	14.7						226.2		.9	.3		293.9
Kansas	20.2		11.2	95.6	539.1			101.0			34.8		2.7	1.5		806.1
Kentucky	2.3			128.4				91.8		15.3	96.9		1.1	.4		336.2
Louisiana	6.3			19.8							40.6		.4	.1		67.2
Maine				.8	43.1		25.1	.8	12.2	12.0	5.6		.1			99.7
Maryland	1.8			3.1		.3			6.3	.5	26.1			.1		38.2
Massachusetts	1.9			1.2				.6	4.6	9.1	1.9			.6		19.9
Michigan	17.5			14.0				17.3		17.2	148.8		.8	.1		215.7
Minnesota	37.4	9.6		13.7	25.5	8.1		219.6			46.2		.4	.2		360.7
Mississippi	54.4			.3	4.5						232.4		.8	.8		293.2
Missouri	31.3			92.0	31.5			11.4		5.7	66.7		1.7	.4	0.2	240.9
Montana	21.7			48.1	8.4			43.7					.8	.1		122.8
Nebraska	66.8	117.4	130.1		8.0			155.8			56.5		2.0	.1		536.7
Nevada	.8			101.4				169.8					.1	.1		272.2
New Hampshire							22.9	5.0		4.5	5.2		.3			37.9
New Jersey					.8					1.6	22.1	.3	.1	.1		25.0
New Mexico	24.4			163.0	15.8			162.7			.2		1.9			368.0
New York	51.1			6.2	138.2		5.4	16.2	17.3	23.1	188.3		1.3	.6		447.7
North Carolina	80.6	1.0	73.3	17.8	102.0			56.5		4.0	95.8		4.8	.2		436.0
North Dakota	18.4	26.8		20.2	41.1			266.2			.4		.3			373.4
Ohio	.5			11.7		2.4	.1			21.0	56.8	31.1	.7	.6		124.9
Oklahoma	35.2			178.5	2.3			13.1	6.3	13.0	69.9		3.6	.1		322.0
Oregon	5.4			23.1	130.8		7.1	23.2	6.2	6.3	20.6		.9	.2		223.8
Pennsylvania				63.9			28.0		61.5	60.0	86.8	1.9	.8	.9		303.8
Rhode Island								4.2	5.5	7.9	7.5					25.1

South Carolina	11.7	27.2	215.9		69.6			2.5		25.3	24.8		1.5	.3		378.8
South Dakota	93.9			27.7	62.3			177.0					.3	.2		361.4
Tennessee	4.4			80.2						61.4	89.6		1.3	.4		237.3
Texas	322.1			321.4	684.8			17.1		126.8	209.8	15.5	12.3	.1	.1	1,710.0
Utah	.2			61.1	8.9			125.0		4.2	.6		.1			200.1
Vermont				.6	16.6			28.9			4.3		.1	.1		50.6
Virginia	5.7	5.6	72.3	8.9	58.2	.1	86.7			44.5	96.2		1.7	.5		380.4
Washington	7.4			137.0				14.0		2.6	21.6		1.4	.3		184.3
West Virginia	8.8			5.6	4.9		22.1	19.6		29.8	16.0		.1	.2		107.1
Wisconsin	68.6			55.9				6.6		.3	89.3		.7	.3		221.7
Wyoming	70.4			29.1				270.7					.8	.1		371.1
Hawaii							23.0		1.1				.4			24.5
District of Columbia											.2					.2
Puerto Rico							28.0						.1	.2		28.3
Total	1,392.3	245.4	737.3	2,209.7	2,367.7	183.6	348.0	2,568.1	138.2	646.2	2,517.0	50.3	64.2	14.0	.3	13,482.3

TABLE 15.—*Mileage, by types of construction, of projects under contract on June 30, 1939*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Grade separations		Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated							Railroad and highways	Between highways	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama	0.1	13.2	147.8	14.1	162.9		18.5			0.2	2.4		3.9	1.4		364.5
Arizona	4.7			9.8				76.1			1.7		.5			92.8
Arkansas	9.7		13.4	51.7	5.5			203.7			15.0		.8	.1		299.9
California	.4				27.3			64.5	8.5	.5	12.6		1.1	1.0		115.9
Colorado				125.6							.3		.6	.1		126.6
Connecticut							11.6		2.9		4.1					18.6
Delaware				18.1							12.7		.2			31.0
Florida	25.0				9.7		.5	32.5			11.4		1.0	.2		80.3
Georgia	31.1	31.2	96.1	55.2	113.4	6.5	33.3	12.8		35.8	43.2		2.1	.7		461.4
Idaho	.2			38.3				28.4			3.4		.6			70.9
Illinois	91.8			52.8		61.1		4.5			127.6		2.3	1.5		341.6
Indiana	36.0			26.0	5.4		8.1	44.2		3.5	98.9		.7			222.8
Iowa	53.4			45.0	17.8			8.8			109.2		.9	1.0		236.1
Kansas	51.5		30.5	50.1	32.9			19.5			12.8		1.0	.2		198.5
Kentucky	8.6			104.4				25.3		18.3	38.1		1.6	.4		196.7
Louisiana	64.8			59.5							24.2		2.1	.6		151.2
Maine				1.1	.3		27.8	2.0	10.6	.8	6.3		.3	.1		49.3
Maryland	2.4			14.4		2.1	1.5	2.7	4.1		55.9		.3	.2	0.1	83.7
Massachusetts								4.6	14.9	13.3	2.8		.3	.1		36.0
Michigan	85.4			43.0	16.0			9.1		1.4	89.1		.5	.1		244.6
Minnesota	153.3	4.8		65.2	49.4			129.4		2.0	33.6	0.1	.6	.7		439.1
Mississippi	135.4			22.1	20.1			13.2		.2	204.3		2.5	.3		398.1
Missouri	48.0			143.7	39.6		36.0		1.7	1.8	72.0		1.3	.9		345.0
Montana	53.5			89.1	34.4			80.3			.3		1.3	.2		259.1
Nebraska	133.7	141.6	194.3	8.4				121.9			18.9		1.7	.5		621.0
Nevada				14.7				47.3					.1	.1		62.2
New Hampshire							10.2	13.5	1.2	1.9	8.3		.1			35.2
New Jersey	2.5			4.1	3.3					3.5	31.6		.1	.1		45.2
New Mexico	21.9			66.4	49.2			7.2					6.6			151.3
New York	35.8			27.7	100.8		.1		4.9	6.0	152.7	.1	1.2	.3		329.6
North Carolina	36.1	2.8	205.6	5.8	152.9		5.1	53.2		.3	60.9		1.1	.3		524.1
North Dakota	19.0	8.4		7.3	11.9			4.0			1.3		.1	.1		52.1
Ohio	2.5		5.0	23.2			29.1			6.8	79.6	20.1	.7	.3	.1	167.4
Oklahoma	6.4			5.6							20.0		1.1	.6		33.7
Oregon	5.8			35.3	99.9		35.2		11.0	8.6	3.8		1.3	.6		201.5
Pennsylvania				36.4			43.9		44.1	13.1	97.6	.1	.7	.3		236.2

Rhode Island									8.3	.2	8.5		.1			17.1
South Carolina	21.0	21.5	99.6							14.0	1.7		1.7	.5		160.0
South Dakota	218.7			5.7	69.0			132.2			10.8		.7	.1		437.2
Tennessee	20.9			50.1	14.8					.3	58.3		1.6	.1		146.1
Texas	257.2		8.8	140.2	282.4		14.9	19.2		55.1	103.7		7.9	1.6	.2	891.2
Utah	1.3			48.2				65.2		2.5	17.1		.1			134.4
Vermont					6.1			20.6	.1				.1			26.9
Virginia	6.3		29.4	3.9	29.4		26.4			15.0	26.7		1.1	.3		138.5
Washington	7.2			45.7	11.1						12.0		1.7			77.7
West Virginia	4.0			12.4			18.5	17.0		7.6	8.0		.1	.9		68.5
Wisconsin	58.7			109.3							177.4		1.7	.8		347.9
Wyoming	72.3			20.4	17.8			61.7					.7	.1		173.0
Hawaii	1.3						19.2		.7				.2			21.4
Puerto Rico							47.8						.6	.6		49.0
Total	1,787.9	223.5	830.5	1,700.0	1,383.3	69.7	387.7	1,324.6	113.0	212.7	1,880.8	20.4	59.6	18.0	.4	10,012.1

TABLE 16.—*Mileage, by types of construction, of projects approved but not under contract on June 30, 1939*

State	Graded and drained	Sand-clay		Gravel		Macadam		Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland-cement concrete	Block	Bridges and approaches	Grade separations, railroad and highways	Total
		Untreated	Treated	Untreated	Treated	Untreated	Treated								
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama			4.6											0.1	4.7
Arizona					10.1			0.7							10.8
Arkansas	0.6			5.7							0.9		0.1		7.3
California								4.6	3.6	1.4	.6				10.2
Colorado				4.2											4.2
Connecticut							0.2		2.3		3.7				6.2
Delaware				12.0							25.7		.1	.1	37.9
Florida	5.5						.4	5.3			20.4		.1		31.7
Georgia	.9	7.0	51.9	11.8	27.0		66.8			2.0	7.7		.3	.1	175.5
Illinois	13.4			8.3		4.1				.2	18.0		.2	.1	44.3
Indiana	9.7			.1	6.6		2.9	12.9			31.6		.1	.1	64.0
Iowa				8.7	31.1						8.0				47.8
Kansas	43.1		30.2	110.0	12.6						24.1		1.5	.2	221.7
Kentucky				48.1				1.4		43.7	5.2		.4	.2	99.0
Louisiana	6.7			22.0							14.6		.3		43.6
Maine							12.9	15.7	2.1	12.2	1.0		.3		44.2
Maryland	9.5			6.2			3.3	1.4					.1		20.5
Massachusetts								5.2	2.7	5.6					13.5
Michigan	3.2			6.4	20.1			13.2			11.0			.1	54.0
Minnesota	11.4			4.1	27.6			75.9			6.1			.2	125.3
Mississippi	18.9		13.4								9.1		.4		41.8
Missouri	11.4			45.8							31.4		.4	.3	89.3
Montana	12.5			5.3											17.8
Nebraska	99.9	58.7	114.0	3.0	3.7			57.9			23.7		.7	.4	362.0
Nevada								9.5							9.5
New Hampshire							6.0	7.1						.1	13.2
New Jersey				4.7						2.4	2.6		.1		9.8
New York				.1			4.7		.5	1.7	22.0		.2	.2	29.4
North Carolina	4.2		3.9		25.0			10.0			27.0		.2		70.3
North Dakota	44.9	8.2			127.7			162.3			.1		.3		343.5
Ohio						.4	5.2			.4	14.3	2.7		.1	23.1
Oklahoma	5.4			65.3	1.4					32.5	26.2		1.6		132.4
Oregon							3.3								3.3
Pennsylvania							7.5		.6		3.5			.3	11.9
South Carolina	23.6	6.6	5.8								.2				36.2
South Dakota	26.9				53.2			26.8			24.9		.2		132.0
Tennessee				3.2						.3	5.4		.1		9.0

Texas	11.3			7.6	52.9			5.3		.6	.7		.3	.2	78.9
Utah	1.3			.1				17.7							19.1
Vermont				1.0				1.6			.6				3.2
Virginia	.1		5.3				7.9			12.1	22.8		.2		48.4
Washington				3.0	1.0			15.1		5.5	1.3		.7	.1	26.7
West Virginia	3.2				.4	5.4				2.5	18.9				30.4
Wisconsin	11.3	10.8		1.8							2.0		.1		26.0
Wyoming				10.4	45.0			10.2					.2		65.8
Hawaii	4.9						9.9			.8			.2		15.8
District of Columbia										1.1	.9			.1	2.1
Puerto Rico							.5								.5
Total	383.8	91.3	229.1	398.9	445.4	9.9	131.5	459.8	11.8	125.0	416.2	2.7	9.4	3.0	2,717.8

CONSTRUCTION OF ROADS THROUGH PUBLIC LANDS AND FEDERAL RESERVATIONS

Special authorizations and appropriations have been made by Congress for the survey, construction, reconstruction, and maintenance of main roads through unappropriated or unreserved public lands, nontaxable Indian lands, and Federal reservations other than the forest reservations, where such land is more than 5 percent of the total area of the State. There are 14 of these Federal-land States, all of them west of the Mississippi River. The percentage of such lands in the several States varies considerably and reaches a maximum of approximately 73 percent in Nevada.

The construction of highways across these relatively large areas that do not contribute to State revenues imposes a serious burden on State highway funds.

The Federal-land highways differ from the forest highways and the Federal-aid highways in that there is no Federal-land highway system. Federal-land funds may be expended on roads which are on the Federal-aid system or on main roads not on the Federal-aid system. Contributions from the States are not required to be used in conjunction with Federal-land funds, but cooperative funds from the States may be used. Federal-land funds are sometimes expended under the supervision of State highway departments, following Federal-aid procedure, and sometimes under the detailed supervision of this organization.

Authorizations for the construction of roads in public lands have been made by eight congressional acts, passed up to the end of the fiscal year 1939. Authorizations have been made available for each fiscal year from 1931 through 1941, with the exception of 1932 and 1937, and total $23,000,000. The authorization for 1939 was $2,500,000; for 1940, $1,000,000; and for 1941, $2,000,000.

Federal-land projects, in large part, involve the grading and draining of new roads and the reconstruction of old roads to greater widths and to higher standards of grade and alinement. Most of these roads are subsequently improved by the addition of gravel and bituminous surfacing. In the effort to spread the relatively small funds over a considerable mileage of road, very little mileage of the higher types of surface, such as bituminous concrete and portland-cement concrete, has been constructed.

During the fiscal year 244 miles of road were brought to completion, and at the end of the year 200 miles were under construction or had been contracted for. The total improved mileage at present is 1,623 miles. Tables 17 to 20 show details concerning work completed during the year and the status at the end of the year.

TABLE 17.—*Public-lands funds allotted to projects completed during the fiscal year 1939*

State	Public-lands funds	Estimated total cost	Miles	State	Public-lands funds	Estimated total cost	Miles
Arizona	$315,826	$335,830	54.5	Oklahoma	$52,097	$59,473	0.1
California	5,395	5,395	7.7	Oregon	60,179	64,432	8.5
Colorado	94,780	94,780	6.8	Utah	23,905	24,538	9.4
Idaho	63,019	63,019	3.2	Washington	38,349	38,985	2.5
Montana	151,769	164,891	14.0	Wyoming	141,526	145,796	23.1
Nevada	507,569	532,232	100.8				
New Mexico	104,918	104,919	13.0	Total	1,559,332	1,634,290	243.6

TABLE 18.—*Public-lands funds allotted to projects under contract and under construction, June 30, 1939*

State	Public-lands funds	Estimated total cost	Miles	State	Public-lands funds	Estimated total cost	Miles
Arizona	$344,217	$344,217	29.6	South Dakota	$67,580	$67,580	6.5
California	173,092	173,092	20.2	Utah	281,910	281,910	12.2
Colorado	30,170	30,170	3.7	Washington	38,089	38,089	1.5
Montana	138,901	141.211	8.4	Wyoming	197,450	197,450	32.7
Nevada	208,416	215,416	56.8				
North Dakota	104,074	104,074	5.2	Total	1,737,181	1,746,491	199.9
Oregon	153,282	153,282	23.1				

TABLE 19.—*Public-lands funds allotted to projects approved but not under contract and balance available for programmed projects, June 30, 1939*

State	Public-lands funds	Estimated total cost	Miles	Balance available for new projects	State	Public-lands funds	Estimated total cost	Miles	Balance available for new projects
Arizona				$220,194	Oklahoma				$39,825
California	$242,089	$250,457	6.5	156,936	Oregon				74,656
Colorado				90,204	South Dakota				61,372
Idaho				126,530	Utah				141,601
Montana				60,595	Washington				14,930
Nevada	34,471	34,471	4.6	221,054	Wyoming				124,628
New Mexico	772	772		302,892					
North Dakota				12,925	Total	$277,332	$285,700	11.1	1,648,342

TABLE 20.—*Mileage of public-lands roads, by types of construction, completed as of June 30, 1939*

State	Graded and drained	Gravel		Macadam, treated	Low-cost bituminous mix	Bituminous macadam	Bituminous concrete	Portland cement concrete	Bridges	Total
		Untreated	Treated							
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Arizona	5.9		79.9		80.8				0.5	167.1
California	.2	13.8	21.3		60.2				.3	95.8
Colorado		21.7			8.0				.1	29.8
Idaho	9.2	50.1			31.5					90.8
Montana	33.0	18.2			18.2				.3	69.7
Nevada		36.5			501.5				.1	538.1
New Mexico		31.3	10.8		28.8			6.0	.3	77.2
North Dakota	9.4	16.0							.1	25.5
Oklahoma					5.6		1.8	2.5	.1	10.0
Oregon	3.5	130.6	5.8	4.0					.1	144.0
South Dakota	12.5	2.9	4.3							19.7
Utah		32.6			141.6		6.8		.1	181.1
Washington	.4	16.8				2.6		3.7		23.5
Wyoming	23.7		15.6		110.8				.3	150.4
Total	97.8	370.5	137.7	4.0	987.0	2.6	8.6	12.2	2.3	1,622.7

Notable from the standpoint of continuous Federal-land construction during the fiscal year are: the Oceanside-Kane Springs highway in California, the Death Valley National Monument-Easterly highway in California, the Railroad Pass-Searchlight highway in Nevada, and the Mineral Hot Springs-Poncha Springs highway in Colorado.

RESTORATION OF FLOOD-DAMAGED ROADS

Special acts during the period 1928–31 authorized funds for reconstruction of flood-damaged roads and bridges in 11 States. Work is still active in 4 States. All authorized funds have been absorbed in

completed work in Florida, New Hampshire, South Carolina, and Vermont. All work planned in Alabama, Georgia, and Louisiana has been completed.

Construction was completed on 43 miles costing $511,947 during the year; 21.1 miles estimated to cost $829,669 were under contract at the close of the year, as shown in table 21; and three States had unobligated balances as follows: Arkansas, $122,507; Kentucky, $15,240; and Mississippi, $140,433.

TABLE 21.—*Status of flood-relief funds provided under special flood-relief acts*

Status and State	Flood-relief funds	Estimated total cost	Miles	Status and State	Flood-relief funds	Estimated total cost	Miles
Completed during the fiscal year:				Under contract:			
Arkansas	$103,544	$207,505	25.2	Arkansas	$96,256	$192,513	9.4
Kentucky	146,470	304,442	17.8	Kentucky	159,068	318,136	7.2
				Mississippi	142,300	299,900	3.4
				Missouri	8,562	19,120	1.1
Total	250,014	511,947	43.0	Total	406,186	829,669	21.1

The Bureau has continued to supervise other projects involving the reconstruction of flood-damaged bridges at the request of the Works Progress Administration. These projects are financed by that organization and the States and, in some instances, partly with Works Program funds administered by the Bureau. Flood-damaged bridges and bridge approaches are reconstructed for the most part on secondary roads. In this work, which is done by contract, the Bureau cooperates closely with the State highway departments much the same as on Federal-aid construction.

During the year 3.2 miles of bridges and approaches costing $3,250,950 were completed. This brings the total of this class of work completed to 38 miles costing $12,283,140. At the close of the year work estimated to cost $250,000 was under contract as shown in table 22.

TABLE 22.—*Status of funds allotted for reconstruction of flood-damaged bridges by the Works Progress Administration to be supervised by the Bureau of Public Roads*

Status and State	Works Progress flood reconstruction funds	Estimated total cost	Miles
Completed during the fiscal year:			
Massachusetts	$1,248,296	$2,304,174	1.6
New Hampshire	123,750	165,000	.1
Pennsylvania	438,726	690,764	1.4
Vermont	41,689	91,012	.1
Total	1,852,461	3,250,950	3.2
Under contract:			
West Virginia	60,500	250,000	.2

Federal funds to aid the States in the immediate repair of highways and bridges on the Federal-aid system damaged by floods or other forces of nature have been made available by two congressional acts. The Hayden-Cartwright Act of June 18, 1934, authorized $10,000,000, and the Federal Aid Highway Act of 1938, authorized $8,000,000 from

any funds available for expenditure under the Federal Highway Act and authorized future appropriation of funds to replace the funds expended for such purposes. These acts make possible the immediate repair of damaged roads and bridges without waiting for specific authorization of funds. The States are required to match these funds in the same manner as regular Federal-aid funds.

Work was completed on 31.2 miles costing $2,759,748 during the year, as shown in table 23. Work estimated to cost $4,124,118 was under contract, and work estimated to cost $448,960 was approved but not yet under contract. Funds paid to the States during the year under this authorization amounted to $1,704,554, bringing the total paid to the States under the Hayden-Cartwright Act to $4,274,430. Funds paid to States during the fiscal year were as follows:

California	$867,830	New Hampshire	$5,405
Colorado	74,032	New York	10,523
Kansas	7,982	Ohio	592,591
Kentucky	5,345	Vermont	47,579
Maine	6,655	Virginia	2,359
Maryland	78,673		
Missouri	5,580	Total	1,704,554

TABLE 23.—*Status of flood-relief funds provided under section 3 of the Hayden-Cartwright Act*

Status and State	Emergency relief funds	Estimated total cost	Miles	Status and State	Emergency relief funds	Estimated total cost	Miles
Completed during the fiscal year:				Under contract—Continued			
California	$687,806	$1,190,870	19.3	Maryland	$87,500	$179,000	0.6
Kansas	94,108	197,420	.2	Missouri	24,334	48,668	.6
Kentucky	14,171	29,239	.7	Ohio	664,060	1,330,780	9.6
Maryland	9,900	20,615	.1	Texas	321,650	657,000	.6
Missouri	5,580	11,420	.2	Vermont	26,400	52,800	.3
Ohio	531,607	1,076,023	8.0				
Vermont	37,586	79,800	2.5	Total	2,194,463	4,124,118	49.9
Virginia	77,180	154,361	.2				
				Approved but contract not awarded:			
Total	1,457,938	2,759,748	31.2	Missouri	55,560	207,160	8.7
				Ohio	120,950	241,800	3.2
Under contract:							
California	1,036,337	1,787,506	37.4	Total	176,510	448,960	11.9
Kentucky	34,182	68,364	.8				

Including work completed in previous years, the total obligations to the end of the fiscal year amounted to $8,387,607, leaving a balance of $9,612,393 for new projects.

WORK-RELIEF HIGHWAY PROJECTS

Work-relief highway projects, begun in the fall of 1933 to relieve distress in drought-stricken areas, have been continued. Road work has been carried on by an arrangement under which the Federal Emergency Administration of Public Works has granted funds to pay material and equipment costs, limited to not more than 30 percent of the total cost, and the labor has been supplied from relief rolls and paid first by the Federal Emergency Relief Administration and later by the Works Progress Administration.

The Bureau, cooperating with the respective State highway departments, has assumed the responsibility of supervising road work under this arrangement.

During the year 625 miles of this kind of work costing $3,824,253 was completed, bringing the total to date to 7,014 miles. Work was under contract at the close of the year on 414 miles, estimated to cost $5,505,828, as shown in table 24.

TABLE 24.—*Status of National recovery work-relief projects*

Status and State	National recovery work-relief funds	Total cost	Miles	Status and State	National recovery work-relief funds	Total cost	Miles
Completed during the fiscal year:				Under contract:			
Oklahoma	$122,400	$408,000	110.0	Minnesota	$717,468	$3,630,851	19.9
Texas	979,433	3,416,253	514.7	Oklahoma	447,600	1,592,000	332.7
				Texas	82,522	282,977	61.5
Total	1,101,833	3,824,253	624.7	Total	1,247,590	5,505,828	414.1

LOAN-AND-GRANT HIGHWAY PROJECTS

The Federal Emergency Administration of Public Works has continued the policy of aiding, by loans or grants or both, the construction of roads and bridges in a number of States. Projects of this kind are initiated by their sponsors with the administration and, after agreement has been reached and funds allotted, are turned over to the Bureau for detailed administration of construction. Practically all of this work is done by the contract method.

This work was begun in 1934 with funds provided by the National Industrial Recovery Act and has been continued with funds allocated under authorization of the Emergency Relief Appropriation Act of 1935 and the Work Relief and Public Works Appropriation Act of 1938. At the close of the fiscal year loans and grants of $76,816,461 had been made for specific projects 17,238 miles in length and estimated to cost $174,746,773. This represents a net increase during the year of 7,760 miles involving $20,380,189 of loan-and-grant funds and estimated to cost $48,355,522. Details by States are shown in table 25.

TABLE 25.—*Status on June 30, 1939, of loan-and-grant Public Works projects transferred by the Public Works Administration to the Bureau of Public Roads for supervision and audit*

ALLOTMENTS FROM NATIONAL INDUSTRIAL RECOVERY ACT

State	Funds allotted by Public Works Administration			Mileage, estimated cost, and funds assigned to specific projects approved under Public Works Administration allotments				
	Tentative allotment by special board for Public Works	Allotment by contracts executed		Miles	Estimated total cost	Funds assigned		
		Grant	Loan			Grant	Loan	Other
Alabama	$70,248	$20,617	$49,631	6.8	$70,248	$20,617	$49,631	
California	1,310,864	1,310,864		16.3	6,063,238	1,310,864		$4,752,374
Connecticut	1,207,596	1,207,596		68.9	4,825,941	1,207,596		3,618,345
Illinois	2,400,618	2,400,618		97.6	8,256,422	2,400,618		5,855,804
Indiana	200,662	200,662		34.4	765,294	200,662		564,632
Iowa	307,587	307,587		823.7	1,061,690	307,587		754,103
Kansas	5,119,130	1,524,130	3,595,000	410.0	5,686,101	1,524,130	3,595,000	566,971
Louisiana	269,258	88,258	181,000	47.3	300,515	88,258	181,000	31,257
Maryland	4,220,000	1,590,000	2,630,000	72.2	5,131,317	1,410,902	2,630,000	1,090,415
Massachusetts	1,702,395	1,702,395		105.1	5,508,720	1,634,636		3,874,084
Michigan	10,000	10,000		29.0	39,818	10,000		29,818
Minnesota	1,337,211	952,211	385,000	472.9	3,261,752	952,211	385,000	1,924,541
Mississippi	559,135	161,149	397,986	85.2	559,135	161,149	397,986	
Missouri	1,026,000	1,026,000		50.6	3,473,587	1,026,000		2,447,587
Montana	1,829,000	579,000	1,250,000	697.8	1,955,463	579,000	1,250,000	126,463
Nebraska	11,500	11,500		59.6	40,120	11,500		28,620
New York	736,814	375,033	361,781	30.9	1,282,140	375,033	361,781	545,326
Ohio	793,180	139,878	653,302	27.1	995,848	139,878	653,302	202,668
South Carolina	76,083	21,283	54,800	28.0	76,083	21,283	54,800	
Texas	1,471,021	931,421	539,600	238.2	3,254,907	931,421	539,600	1,783,886
Washington	2,270,890	2,270,890		1,275.1	8,209,058	2,270,890		5,938,168
West Virginia	2,000,000	2,000,000		453.7	6,771,399	2,000,637		4,770,762
Wisconsin	454,300	142,300	312,000	86.4	526,177	142,300	312,000	71,877
Total	29,383,492	18,973,392	10,410,100	5,216.8	68,114,973	18,727,172	10,410,100	38,977,701

ALLOTMENTS FROM EMERGENCY RELIEF APPROPRIATION ACT OF 1935

California	$57,821	$57,821		.4	$128,842	$57,821		$71,021
Colorado	3,000,000	3,000,000		266.6	7,267,500	3,000,000		4,267,500
Florida	71,514	71,514		.6	158,921	71,514		87,407
Illinois	586,673	586,673		114.1	1,396,151	586,673		809,478
Iowa	393,319	393,319		862.1	903,659	393,319		510,340
Kansas	14,463	14,463		.6	33,364	14,463		18,901
Maryland	1,000,000	1,000,000		25.4	1,852,497	833,624		1,018,873
Michigan	119,435	119,435		16.5	290,093	119,435		170,658
Minnesota	152,389	152,389		69.2	345,351	152,389		192,962
Mississippi	15,325,683	15,325,683		1,395.0	34,165,014	15,229,197		18,935,817
Missouri	396,700	396,700		364.5	881,690	396,700		484,990
Nebraska	6,612	6,612		18.0	14,915	6,612		8,303
New Jersey	29,863	29,863		3.1	66,362	29,863		36,499
New York	212,872	212,872		28.7	518,538	212,872		305,666
Ohio	744,519	356,123	$388,396	229.5	805,399	356,123	$388,396	60,880
Pennsylvania	349,969	349,969		1.7	625,682	281,557		344,125
South Carolina	707,069	474,069	233,000	249.7	1,071,831	474,069	233,000	364,762
Texas	2,930,193	2,440,193	490,000	381.9	5,857,571	2,440,193	490,000	2,927,378
Utah	45,900	45,900		29.1	116,353	45,900		70,453
Washington	730,093	730,093		184.8	1,889,022	730,093		1,158,929
Total	26,875,087	25,763,691	1,111,396	4,241.5	58,388,755	25,432,417	1,111,396	31,844,942

TABLE 25.—*Status on June 30, 1939, of loan-and-grant Public Works projects transferred by the Public Works Administration to the Bureau of Public Roads for supervision and audit*—Continued

ALLOTMENTS FROM WORK RELIEF AND PUBLIC WORKS APPROPRIATION ACT OF 1938

State	Funds allotted by Public Works Administration			Mileage, estimated cost, and funds assigned to specific projects approved under Public Works Administration allotments				
	Tentative allotment by special board for Public Works	Allotment by contracts executed		Miles	Estimated total cost	Funds assigned		
		Grant	Loan			Grant	Loan	Other
Alabama	$84,965	$84,965		12.0	$188,811	$84,965		$103,846
California	205,278	205,278		22.7	388,153	174,667		213,486
Colorado	454,950	454,950		51.6	1,010,950	446,150		564,800
Connecticut	1,784,250	1,784,250		20.0	2,257,569	1,013,991		1,243,578
Florida	769,223	769,223		83.2	1,812,306	747,752		1,064,554
Georgia	605,700	605,700		85.9	1,242,930	559,090		683,840
Idaho	54,418	54,418						
Illinois	2,409,191	2,409,191		239.0	4,624,670	1,929,795		2,694,875
Iowa	1,140,116	1,140,116		1,138.4	2,073,052	941,061		1,131,991
Kansas	504,098	504,098		26.7	786,325	353,846		432,479
Kentucky	100,945	100,945		25.0	224,322	100,945		123,377
Massachusetts	49,050	49,050		.2	95,467	42,960		52,507
Michigan	1,917,990	[1] 1,937,790		325.0	4,011,479	1,805,004		2,206,475
Minnesota	2,138,563	[1] 2,255,092		1,542.7	3,258,923	1,443,310		1,815,613
Mississippi	3,074,295	3,074,295		387.2	7,052,430	3,003,714		4,048,716
Missouri	787,156	787,156		685.1	1,709,664	767,857		941,807
Nebraska	24,750	24,750		.5	60,936	24,750		36,186
New Jersey	37,006	37,006		.4	82,235	37,006		45,229
New York	90,000	90,000		.2	220,138	90,000		130,138
North Dakota	590,180	590,180		255.0	1,260,945	567,420		693,525
Ohio	1,008,594	1,008,594		1,319.3	1,671,252	751,254		919,998
Oklahoma	105,300	105,300		80.4	224,331	100,036		124,295
Oregon	489,519	489,519		123.4	972,710	433,510		539,200
Pennsylvania	178,627	178,627		4.6	371,456	167,155		204,301
South Carolina	713,185	[1] 805,435		371.2	1,173,229	527,953		645,276
Texas	2,387,338	2,387,338		590.1	5,017,892	2,258,329		2,759,563
Vermont	250,055	[1] 242,489		4.1	458,576	202,408		256,168
Washington	1,529,070	[1] 1,563,270		242.3	3,005,638	1,339,200		1,666,438
West Virginia	1,156,050	1,156,050		130.1	2,560,187	1,065,744		1,494,443
Wisconsin	160,875	160,875		13.1	426,469	155,504		270,965
Total	24,800,747	25,055,950		7,779.4	48,243,045	21,135,376		27,107,669

[1] Differences due to "advice of contracts" not yet received from Public Works Administration.

NATIONAL-FOREST ROAD CONSTRUCTION

Improvement of the system of forest highways of 21,981 miles located in 36 States, Alaska, and Puerto Rico was continued during the year when 413 miles were brought to completion under Bureau supervision. However, much of the work was further improvement of previously improved roads, and only 164 miles were improved for the first time.

When the improvement of forest roads and trails with annual authorizations began 23 years ago, the forest areas were almost inaccessible to wheeled vehicles. During the first years of improvement, the construction was almost entirely of the pioneer type. As improvement of main highways throughout the country advanced, the standards of forest-highway improvement were raised. When the Federal-aid and State highway systems were designated, it became necessary to designate and provide for the improvement of routes across forest areas forming essential links in these systems. Thirty-nine percent of the forest-highway system as now constituted provides necessary links in the Federal-aid system, and another 39 percent is similarly related to portions of State systems not on the

Federal-aid system. As improvement of these systems has progressed, there has been strong pressure to open the impassable sections through the forests. To accomplish this, with the funds that have been available, many miles of road have been built according to the principles of stage construction. The first stage has included only a partial provision of the improvement known to be ultimately desirable but has been so designed that further improvements may be provided in successive steps as funds are provided.

At the end of the fiscal year, work had been done on 6,832 miles, or 31 percent, of the forest-highway system. The greater portion of the system is still unimproved, but greatly increased use of the surfaced sections, increase in speed of vehicles, and a general raising of highway standards have made necessary a concentration of present efforts on the modernizing of those highways built in the early stages of the program. Of the 413 miles completed in 1939, 249 miles were second- or third-stage improvement, and work was done for the first time on 164 miles. The existing forest highways are being raised to higher standards and are attracting increasing thousands of tourists each year, but extension of the surfaced mileage in the system is progressing at a slow pace.

Construction of forest highways, within the limits of Federal funds authorized, is not contingent upon the provision of State or local funds, but in past years the State and local interest in obtaining construction of particular roads has led to the provision of cooperative funds that have materially accelerated the program. In the past few years, there has been a marked decrease in the amount of State and local funds offered for use on forest roads, and the program has been supported almost wholly with Federal funds. This is partly explained by the small mileage of entirely new construction. Communities adjacent to the forests have a stronger interest in the opening up of new routes than in betterment of routes already open to travel.

The work done under the direction of this Bureau and reported here includes all improvements classified as major. Minor road improvements are administered by the Forest Service. Major projects include all work on the forest-highway system except those that do not require the technical services of a highway-engineering organization or those having an estimated average cost of less than $2,000 per mile. Forest-development road projects of an estimated average cost greater than $5,000 per mile, and those requiring the services of a highway-engineering organization are also classed as major projects.

Authorizations for forest-road work have been at the rate of $14,000,000 annually in the fiscal years 1938 and 1939, and $10,000,000 for 1940.

At the beginning of the year the active program involved $10,224,747, of which $6,825,767 was involved in work under contract and force account construction, $1,647,091 in surveys, $1,426,578 in maintenance, and $325,311 for miscellaneous items. There was available for new work $16,758,024, of which $6,728,897 was for programmed work not under contract, and $10,029,127 was available for additional new projects. Of the latter amount $8,180,139 has been assigned to major projects and $219,429 to minor projects during the year, leaving a balance of $1,629,559 available at the end of the year for new projects. The amount of $10,029,127 consists of

$6,666,667 authorized by the act of June 8, 1938, for the fiscal year 1940, apportioned December 27, 1938, and $3,362,460 from previous apportionments.

Major work to cost $8,657,996 was put under contract, and the roads completed cost $8,026,652.

At the close of the year the forest-road work amounted to $10,856,091, of which work under contract and force-account construction was $7,815,957, surveys $1,448,368, maintenance $1,237,599, and miscellaneous items $354,167. The amount available for new work was $7,880,599, of which $6,251,040 had been assigned to specific projects then placed under contract, and $1,629,559 was available for additional projects. These amounts include the $10,000,000 authorized for forest-road work in the fiscal year 1940.

Tables 26–29 show the mileage of the forest-road system, progress in improvement during the past year, and the present condition of improvement.

TABLE 26.—*Classification of the mileage of the forest-highway system at end of fiscal year 1939*

Region and State	Class 1 [1]	Class 2 [2]	Class 3 [3]	Total
Western:	*Miles*	*Miles*	*Miles*	*Miles*
Alaska			352.8	352.8
Arizona	345.8	268.6	445.0	1,059.4
California	670.7	1,252.7	501.8	2,425.2
Colorado	625.0	1,091.0	94.0	1,810.0
Idaho	721.2	165.3	191.5	1,078.0
Montana	666.0	304.6	231.0	1,201.6
Nevada	104.7	282.2	31.0	417.9
New Mexico	162.0	522.0		684.0
Oregon	719.3	352.6	310.4	1,382.3
South Dakota	227.0		86.0	313.0
Utah	191.5	471.4	67.2	730.1
Washington	391.3	123.1	246.8	761.2
Wyoming	387.3	37.0	217.7	642.0
Total	5,211.8	4,870.5	2,775.2	12,857.5
Eastern:				
Alabama	4.0	20.0	31.0	55.0
Arkansas	274.6	310.3	44.6	629.5
Florida	27.4	218.9		246.3
Georgia	110.3	36.5	58.5	205.3
Illinois	223.1	27.5	35.0	285.6
Kentucky	132.8	132.1	28.5	293.4
Louisiana	66.1	369.4	21.9	457.4
Maine			11.0	11.0
Michigan	466.7	283.8	274.4	1,024.9
Minnesota	179.4	217.7	186.9	584.0
Mississippi	204.0	264.0	71.0	539.0
Missouri	426.2	160.1	247.3	833.6
Nebraska	10.4		18.4	28.8
New Hampshire	40.9	92.1	41.7	174.7
North Carolina	483.6	279.0	51.5	814.1
Oklahoma	31.5	17.0	13.5	62.0
Pennsylvania	123.8	228.7	18.9	371.4
Puerto Rico			21.0	21.0
South Carolina	237.8	99.2	11.0	348.0
Tennessee	146.2	98.8	85.0	330.0
Texas	123.4	168.4	111.2	403.0
Vermont	32.7	43.2	58.6	134.5
Virginia	79.0	135.4	241.7	456.1
West Virginia	131.0	168.2	66.6	365.8
Wisconsin	85.7	177.0	186.3	449.0
Total	3,640.6	3,547.3	1,935.5	9,123.4
Grand total	8,852.4	8,417.8	4,710.7	21,980.9

[1] Class 1. Forest roads forming sections of the Federal-aid highway system, either wholly within or, when so designated by the Chief of the Forest Service and the Chief of the Bureau of Public Roads, partly without and adjacent to the national forests.

[2] Class 2. Forest roads, not of class 1, which are parts of approved State highway systems, when so designated by the Chief of the Forest Service and the Chief of the Bureau of Public Roads.

[3] Class 3. All other forest roads of primary importance to counties or communities.

TABLE 27.—*Mileage of forest-highway projects completed during year and total completed to end of fiscal year* [1]

Region and State	Initial improvement and stage construction	Initial improvement	Total to June 30, 1939
Western:	*Miles*	*Miles*	*Miles*
Alaska	32.6	8.4	246.5
Arizona	28.8	2.6	576.4
California	81.1	44.2	825.7
Colorado	12.4	8.1	544.6
Idaho	29.0	9.1	700.1
Montana	32.8	16.4	625.8
Nevada	19.5	9.4	185.8
New Mexico	22.6	1.4	315.1
Oregon	37.9	10.4	1,027.0
South Dakota	4.0		61.1
Utah	12.2	7.3	362.9
Washington	16.7	9.5	340.0
Wyoming	29.5	2.4	360.2
Total	359.1	129.2	6,171.2
Eastern:			
Alabama			5.1
Arkansas	8.8	8.8	133.8
Florida	.2		61.6
Georgia	15.8		21.3
Illinois			4.7
Kentucky			.1
Louisiana			.5
Michigan			56.7
Minnesota			120.1
Mississippi	.1	.1	.1
Missouri	6.2	6.2	14.2
Nebraska			8.7
New Hampshire	1.1	1.1	29.1
North Carolina	3.2	.1	50.9
Oklahoma			16.1
Pennsylvania			10.6
South Carolina	.8	.8	16.9
Tennessee			43.2
Texas	5.1	5.1	5.1
Virginia	6.6	6.6	29.5
West Virginia	1.7	1.7	10.3
Wisconsin	4.1	4.1	22.4
Total	53.7	34.6	661.0
Grand total	412.8	163.8	6,832.2

[1] Changes in the mileage of completed road, resulting from abandonments, relocations, and correction resulting from recent surveys are reflected in this table.

TABLE 28.—*Mileage of forest highways under construction as of June 30, 1939*

Region and State	Graded and drained	Water-bound macadam	Bituminous surface treatment	Low-cost bituminous mix	Bituminous macadam	Portland-cement concrete pavement	Bridges	Total
Western:	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alaska		13.0						13.0
Arizona	24.3	1.7	18.8					44.8
California	48.7		29.2	20.5			0.2	98.6
Colorado		23.6					(1)	23.6
Idaho	22.1	40.1		.9			.1	63.2
Montana	5.0	1.2	25.2					31.4
Nevada		6.9						6.9
New Mexico		4.1						4.1
Oregon	5.8	7.1	34.0		2.0	0.2		49.1
South Dakota			3.8	3.4			(1)	7.2
Utah	1.6	5.6						7.2
Washington	13.5							13.5
Wyoming		8.7	2.1				.1	10.9
Total	121.0	112.0	113.1	24.8	2.0	.2	.4	373.5
Eastern:								
Arkansas	1.8	.3		1.6			0.1	3.8
Louisiana		.3					(1)	.3
Michigan		9.7					(1)	9.7
Minnesota	20.4						(1)	20.4
Missouri		16.9					(1)	16.9
New Hampshire		7.5					.1	7.6
North Carolina		8.8	9.1					17.9
Pennsylvania					1.3			1.3
Texas		6.5					(1)	6.5
West Virginia		6.4						6.4
Wisconsin	7.1							7.1
Total	29.3	56.4	9.1	1.6	1.3		.2	97.9
Grand total	150.3	168.4	122.2	26.4	3.3	.2	.6	471.4

[1] Mileage less than 0.1.

TABLE 29.—*Completed forest highways by States and by types to June 30, 1939*

Region and State	Graded and drained	Sand-clay	Traffic-bound surfaces of miscellaneous material	Bituminous surface treatment	Low-cost bituminous mix	Bituminous macadam	Portland-cement concrete	Bridges	High-way-railroad grade separation	Total
Western:	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alaska			244.1					2.4		246.5
Arizona	209.7		285.7	41.4	15.4	23.4		.8		576.4
California	269.3		170.5	273.6	109.6			2.6	0.1	825.7
Colorado	153.6		245.3	12.6	132.8			.2	.1	544.6
Idaho	292.7		266.7		138.3		0.1	2.3		700.1
Montana	215.1		246.0	37.5	125.2			1.9	.1	625.8
Nevada	46.1		61.5	16.1	62.0			.1		185.8
New Mexico	42.3		195.0	12.3	65.3			.2		315.1
Oregon	154.6		614.4	167.1	72.3	14.5	.3	3.8	(1)	1,027.0
South Dakota			42.4		18.7					61.1
Utah	133.5		166.9	25.0	36.9			.6		362.9
Washington	96.1		237.5	4.4				2.0		340.0
Wyoming	38.7		227.1	8.7	84.4			1.3		360.2
Total	1,651.7		3,003.1	598.7	860.9	37.9	.4	18.2	.3	6,171.2
Eastern:										
Alabama			5.1							5.1
Arkansas	95.9		37.2					0.7		133.8
Florida		4.3		26.6	29.8			.9		61.6
Georgia	3.0		10.4	7.9				(1)		21.3
Illinois			4.7							4.7
Kentucky								.1		.1
Louisiana			.4					.1		.5
Michigan			56.7					(1)		56.7
Minnesota	43.8		60.0		16.1			.2		120.1
Mississippi	(1)							.1		.1

[1] Mileage less than 0.1.

TABLE 29.—*Completed forest highways by States and by types to June 30, 1939*—Con.

Region and State	Graded and drained	Sand-clay	Traffic-bound surfaces of miscellaneous material	Bituminous surface treatment	Low-cost bituminous mix	Bituminous macadam	Portland-cement concrete	Bridges	High-way-railroad grade separation	Total
Eastern—Contd.	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Missouri			14.2							14.2
Nebraska	2.2	6.5								8.7
New Hampshire			14.5	14.5				0.1		29.1
North Carolina	11.0		9.8	30.1				(1)		50.9
Oklahoma	.1		16.0							16.1
Pennsylvania			1.7			8.9				10.6
South Carolina				16.8				.1		16.9
Tennessee			43.2							43.2
Texas	5.0							.1		5.1
Virginia	3.6		2.3	17.1		6.5		(1)		29.5
West Virginia	7.6		2.6					.1		10.3
Wisconsin	8.3		14.1							22.4
Total	180.5	10.8	292.9	113.0	45.9	15.4		2.5		661.0
Grand total	1,832.2	10.8	3,296.0	711.7	906.8	53.3	.4	20.7	0.3	6,832.2

ROAD CONSTRUCTION IN NATIONAL PARKS AND MONUMENTS

National parks and monuments have been established in 33 States, the largest and best known being in the Western States. These areas of exceptional natural phenomena and places of particular historic significance and scenic beauty are recreation grounds for the entire Nation. Nature and events in past history have provided places that everyone desires to see, and highways are the primary requirement in making them accessible to thousands of people who must plan vacation trips of moderate cost.

In addition, over 900 miles of parkways have been established by Congress in the East. These parkways connect points of special interest to tourists and are located on a right-of-way sufficiently broad to give complete control of roadside development. One follows closely the crest of the Blue Ridge Mountains between the Shenandoah National Park in Virginia and the Great Smoky Mountains National Park in North Carolina. Another follows the old historic trail between Natchez, Miss., and Nashville, Tenn.

The construction of roads in and approaching national parks, monuments, and parkways is a responsibility of the Bureau under an agreement with the National Park Service. Highway construction in national parks and monuments is carried on with the cooperation of the Branch of Plans and Design of the National Park Service in locating and planning highways to fit them into and preserve the natural beauty of the parks.

At the close of the year, 1,577 miles of road had been constructed in the national parks and monuments, an increase of 146 miles during the past year. This mileage includes both approach roads and parkways. In addition, 143 miles of road previously constructed were further improved, in most instances by placing a better surface. The completed mileage is shown by parks and monuments in table 30, and by types in table 31.

TABLE 30.—*Highways completed in or leading to national parks and monuments during fiscal year 1939* [1]

Park, monument, or parkway	Initial improvement and stage construction	Initial improvement completed	Total to June 30, 1939
	Miles	*Miles*	*Miles*
Acadia	0.1	0.1	15.4
Blue Ridge	67.2	19.3	134.1
Boulder Dam	9.4	9.4	9.4
Bryce Canyon			21.7
Carlsbad Caverns			8.4
Chalmette			.5
Chickamauga-Chattanooga			17.6
Colonial	2.0	2.0	14.5
Crater Lake	19.1	2.5	60.5
Devils Tower			.3
Fort Donelson			2.7
Fort Matanzas			.6
Fort Pulaski			.3
Fredericksburg-Spotsylvania			23.1
General Grant	5.1	4.7	15.0
George Washington Birthplace			2.6
Gettysburg	2.2	2.2	9.5
Glacier			74.4
Grand Canyon	46.3	30.9	193.0
Great Smoky Mountains	6.5	2.8	29.1
Guilford Courthouse			2.6
Hawaii			35.6
Hot Springs			3.5
Kill Devil Hill			1.6
Lassen Volcanic			35.1
Meriwether Lewis			1.8
Mesa Verde			32.0
Morristown			2.6
Mount Rainier	4.6	4.6	86.3
Natchez Trace	36.1	36.1	36.1
National Capital parks	1.6	.5	6.1
Petersburg	1.9	.6	7.9
Petrified Forest	4.8		31.1
Rocky Mountain			51.4
Scotts Bluff			1.6
Sequoia	12.5		46.1
Shenandoah	42.4	14.1	102.7
Shiloh			10.6
Vicksburg	3.1	3.1	8.4
Wind Cave			15.9
Yellowstone	13.0	12.5	302.2
Yosemite	11.0	.5	104.5
Zion			18.7
Total	288.9	145.9	1,577.1
Low-standard access roads (not included above)	9.8	7.0	18.0

[1] Changes in mileage due to division of regular and low-standard roads and to corrections resulting from final surveys are reflected in this table.

TABLE 31.—*Highways completed in or leading to national parks and monuments at end of fiscal year 1939, by types*

Park, monument, or parkway	Graded and drained	Gravel	Bituminous treatment	Bituminous mixture	Bituminous macadam	Bituminous concrete	Portland cement concrete	Bridges	Total
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Acadia			7.4		8.0				15.4
Blue Ridge	0.6	86.1	18.0	29.1				0.3	134.1
Boulder Dam				9.4					9.4
Bryce Canyon				21.7					21.7
Carlsbad Caverns				8.4					8.4
Chalmette							0.5		.5
Chickamauga-Chattanooga				10.4			7.2		17.6
Colonial	2.7	.1	1.1				10.4	.2	14.5
Crater Lake	2.9	10.1	1.9	38.7	6.8			.1	60.5
Devils Tower								.3	.3
Fort Donelson				2.7					2.7
Fort Matanzas				.5				.1	.6

TABLE 31.—*Highways completed in or leading to national parks and monuments at end of fiscal year 1939, by types*—Continued

Park, monument, or parkway	Graded and drained	Gravel	Bituminous treatment	Bituminous mixture	Bituminous macadam	Bituminous concrete	Portland cement concrete	Bridges	Total
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Fort Pulaski	0.1							0.2	0.3
Fredericksburg-Spotsylvania			17.7	5.2		0.2			23.1
General Grant	12.6		2.4						15.0
George Washington Birthplace			2.6						2.6
Gettysburg			2.2	.8		6.5			9.5
Glacier	16.4	23.7	34.1					.2	74.4
Grand Canyon		.7	31.7	160.5				.1	193.0
Great Smoky Mountains	.4	1.2	23.5	4.0					29.1
Guilford Courthouse						2.6			2.6
Hawaii			10.6	9.0	16.0				35.6
Hot Springs			3.5						3.5
Kill Devil Hill				1.6					1.6
Lassen Volcanic				35.1					35.1
Meriwether Lewis				1.8					1.8
Mesa Verde				32.0					32.0
Morristown		2.6							2.6
Mount Rainier	25.1	24.7		20.7	15.5			.3	86.3
Natchez Trace	36.1								36.1
National Capital parks			1.0			4.4	0.6	.1	6.1
Petersburg			6.0				1.9		7.9
Petrified Forest			4.9	26.0				.2	31.1
Rocky Mountain			8.0	43.4					51.4
Scotts Bluff							1.6		1.6
Sequoia			8.1	37.9				.1	46.1
Shenandoah	6.2	13.8	3.0	68.5		11.2			102.7
Shiloh	.2	.1		3.7			6.6		10.6
Vicksburg	.2	.4	.4			.1	7.2	.1	8.4
Wind Cave				15.9					15.9
Yellowstone		37.4	108.1	155.9				.8	302.2
Yosemite	9.4	10.5	26.3	27.7	15.8	8.3	6.2	.3	104.5
Zion				17.6			1.1		18.7
Total	112.9	211.4	322.5	788.2	62.1	33.3	43.3	3.4	1,577.1
Low-standard access roads (not included above)									18.0

In Grand Canyon National Park the grading and base-course construction of the northern approach from Jacobs Lake to the north rim of the canyon were completed. Funds have already been allotted for a bituminous plant-mix surface on this highway. In Mount Rainier National Park both the Westside and Stevens Canyon routes, which are of considerable length, are being improved by including sections in each year's program. Work is now being concentrated in Stevens Canyon. In Crater Lake National Park the last section of the loop around the lake between Government Camp and Kerr Notch is approaching completion. In Yosemite the Big Oak Flat road route, involving difficult location and construction, is completed. The tunnels on this route are being lined and sections between these tunnels are being surfaced. There still remains a long uncompleted gap on the Tioga Road in Yosemite. This is a superb mountain highway through some of the most rugged of the high Sierras, crossing the Sierras at Tioga Pass at an elevation of nearly 10,000 feet. Additional work on this road is planned. Roads within Yellowstone National Park and the approach roads from the east and northeast are being improved. Another section of the Fresno-General Grant Approach Road was completed, leaving only one more section, about 5 miles in length, to be built in order to complete the highway.

In the Eastern States attention is being centered on the construction of parkways. The Blue Ridge Parkway following closely the crest of the Blue Ridge Mountains for approximately 480 miles passes through Virginia and North Carolina and connects the Shenandoah and Great Smoky Mountains National Parks. Approximately 134 miles has been completed and 170 miles is under construction. A portion of the mileage under construction is surfacing of roads previously graded.

The Natchez Trace Parkway passes through historic sections of Mississippi, Alabama, and Tennessee for approximately 455 miles. Approximately 36 miles of this parkway are now complete, and 11 additional miles are under construction.

Mileage of highways under construction is listed by location and types in table 32.

TABLE 32.—*Highways under construction in or leading to national parks and monuments at end of fiscal year 1939, by types*

Park, monument, or parkway	Graded and drained	Gravel	Bituminous treatment	Bituminous mixture	Portland-cement concrete	Bridges	Total
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Acadia			3.1				3.1
Blue Ridge Parkway		70.2	38.7	62.1			171.0
Boulder Dam recreational area				3.4			3.4
Chickamauga-Chattanooga			9.0				9.0
Crater Lake	8.3						8.3
Glacier			16.7	22.0			38.7
Great Smoky Mountains		1.5					1.5
Mount Rainier	2.5		13.7				16.2
Natchez Trace	10.6						10.6
National Capital parks						0.1	.1
Rocky Mountain				8.1			8.1
Sequoia				19.8			19.8
Shenandoah			4.4	9.4			13.8
Vicksburg					1.2		1.2
Yellowstone			9.2	66.9		.2	76.3
Yosemite	2.2	2.1	8.6	42.3	.5	.1	55.8
Zion-Bryce Canyon		6.8					6.8
Total	23.6	80.6	103.4	234.0	1.7	.4	443.7

The mileage of approach roads completed and under construction and approved for construction is reported in table 33.

TABLE 33.—*Location and length of approach roads to national parks and monuments, June 30, 1939*

Road	Park	Designated	Under construction	Completed
		Miles	*Miles*	*Miles*
Fresno-General Grant	General Grant	13.2		8.6
Cameron-Desert View	Grand Canyon	28.1		28.1
South Approach	do	52.3		52.3
Jacobs Lake-North Rim	do	31.2		[1] 30.9
Mineral-Lassen Volcanic	Lassen Volcanic	8.8		[2] 4.7 [2] 4.1
Sequoia-General Grant	Sequoia-General Grant	13.5		13.5
Custer-Wind Cave	Wind Cave	8.6		8.6
Southwest Approach	Yellowstone	13.9		13.9
Moran-Yellowstone	do	24.0		5.8
Red Lodge-Cooke City	do	59.7		59.7
East Approach	do	23.0	8.8	13.7
Zion-Bryce Canyon	Zion-Bryce Canyon	29.1	6.8	
Cedar Breaks	Cedar Breaks	2.6		
Total		308.0	15.6	239.8

[1] Reflects correction resulting from final survey.
[2] Graded as a forest-road project. Figure not included in total.

INTER-AMERICAN HIGHWAY

For some years the Government of the United States has assisted Central American countries in the improvement of the highway from the southern border of Mexico to Panama City, Panama, which is a part of the projected route from Laredo, Tex., to Panama City. The cooperation has been through the Department of State, the Bureau of Public Roads supplying the needed engineering services and direction. In 1934 a route was recommended after a careful reconnaissance survey. Recent activity by this Government has been supported by an authorization of $1,000,000 made in 1934 for cooperation in the survey and construction of highways. Surveys have been made in several countries, and assistance was given to Panama, Costa Rica, Nicaragua, Honduras, and Guatemala in the erection of bridges.

During the year the bridge construction was largely completed, and the giving of engineering advice and assistance was continued under an authorization of $50,000 made in June 1938.

The Chiriqui Bridge in Panama and approaches were completed in March 1939, and the structure was formally opened by the President of the Republic during a special fiesta proclaimed for the purpose. Panama is obligated under a cooperative arrangement to erect the Rio Chirigagua and the Rio San Cristobal Bridges between David and Conception. Steel for these bridges has been supplied by the United States. The substructures for both of these spans had been completed and arrangements were made for the erection of steel in May 1939, but erection has been postponed until the next dry season. There is reluctance in Central America to carry on hazardous work during the rainy season.

In Guatemala, bridges over Rio Tiucal, Rio Zonjon, and Rio Mongoy were finished by local forces.

Engineering assistance was given in the construction of 12.5 miles of road in Guatemala, 18 miles in Nicaragua, and 25 miles in Costa Rica. The Nicaraguan section of road was practically complete in June 1939. The work in Guatemala is expected to be completed soon. Steady progress has been made on the 25 miles of construction in Costa Rica between Cartago and San Marcos. This highway crosses the Continental Divide at an altitude of approximately 7,200 feet, over a range of mountains having very precipitous slopes and at places the material is very unstable. Several months more will be required to complete the work.

The cooperative work of the United States has aroused a strong interest in Central American countries in the Inter-American Highway, and several countries are planning, on their own account, to extend or reconstruct sections of the route. During the past fiscal year requests for additional surveys have been received from Nicaragua, Honduras, and Guatemala. All needed survey work in Panama was completed in the preceding year.

The survey requested in Nicaragua between Las Maderas Bridge and the town of Sebaco, a distance of 22.5 miles, has been completed, and construction should begin during the present year.

In Honduras, 34 miles were surveyed from the Choluteca Bridge westward to the Nacaome River. This section of road passes through all of the largest towns on the Pacific side, including San Lorenzo, the only Pacific port of entry.

In Guatemala, surveys on 89.5 miles of road between Asuncion Mita and Guatemala City were completed. A passable highway exists throughout this section, but it has sharp curves and some bad location that can be rectified. This survey completes the detailed planning of the route from Guatemala City to the frontier of El Salvador.

All road plans resulting from surveys have been drafted according to the standards used on Federal-aid work in the United States, and the plans will be furnished to the respective countries for their use in continuing construction.

Table 34 indicates the condition of the Inter-American Highway from Laredo, Tex., to the Canal Zone at the close of the year.

TABLE 34.—*Status of improvement of the Inter-American Highway* [1]

Type	Mexico	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica	Panama	Total
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Paved	825		72		16	47	163	1,123
All weather	156	273	48	30	17		145	669
Dry weather	329	43	53	29	99	66	34	653
Trails	402		8	31	113	243	25	822
Total	1,712	316	181	90	245	356	367	3,267

[1] From the United States-Mexico border to the Panama Canal.

During the year Bureau engineers have been loaned to Venezuela, Colombia, and Ecuador, under provisions of the acts, Public No. 545, Seventy-fifth Congress, and Public No. 63, Seventy-sixth Congress.

An engineer was assigned to Venezuela in January 1939, for 6 months, to advise regarding the location of new roads. An American contracting concern has notified the Bureau that it has contracted for approximately 150 miles of road recommended by our engineer.

A soil expert was assigned to the State of Cundinamarca, Colombia, which includes the Federal district and the capital of that Republic. His assignment for 3 months has been extended for a second like period.

In June 1939, an engineer was furnished the Republic of Ecuador, on request of that Government, to advise on a general system of improved roads, and at the close of the fiscal year he was engaged in that work.

On May 25, 1939 the Export-Import Bank of Washington officially requested the Secretary of Agriculture to arrange for the assignment of engineers from the Bureau of Public Roads to assist the bank in connection with the extension of credits for public road construction in Latin America. Authority for such assignments was given by the Secretary of Agriculture, and negotiations covering details were in progress at the close of the year. In this connection a request has been received for the assignment of an engineer to Paraguay.

In January 1939, the Third Pan American Highway Congress was held at Santiago, Chile, and a representative of the Bureau was designated as the technical head of the American delegation.

The Congress took steps to obtain concerted action by the several countries of South America in designating a Pan American highway

system to connect at Panama with the highway projected from the United States and to establish the necessary international highway connections throughout the southern continent.

Under the Pan American Highway Convention, signed at Buenos Aires in 1936, a financial committee was created and the Bureau has cooperated with the American representative of this committee by furnishing estimates and information pertinent to its work.

Under that same convention, the Bureau was officially designated by the Secretary of State as the depository for exchange of highway information, with similar agencies designated for each of the Latin American countries.

TRANSPORTATION, ECONOMIC, AND STATISTICAL INVESTIGATIONS

HIGHWAY-PLANNING SURVEYS

At the close of the year 46 States and the District of Columbia had undertaken State-wide highway-planning surveys in cooperation with the Bureau under authority contained in the Hayden-Cartwright Act of 1934 and subsequent legislation which authorized the Secretary of Agriculture to approve allotments of not to exceed 1½ percent of the amount of Federal highway funds apportioned for any year for surveys, plans, and engineering, and economic investigations of projects for future construction.

In a number of States preliminary reports have been prepared summarizing portions of the data for the guidance of the legislature in connection with specific proposals, or to aid the State highway departments in setting up yearly programs. In several States work has been started on a comprehensive initial report, summarizing and correlating the data obtained in all phases of the survey, following in general an outline suggested by the Bureau. While few comprehensive reports have yet been completed, highway officials in all States are making constant use of the information in connection with problems that arise from day to day.

One of the most generally useful products of the planning surveys is a series of large-scale State and county maps. The county maps, generally on a scale of 1 inch to 1 mile or greater, show, in addition to transportation facilities, all physical features and man-made improvements, and will form the first up-to-date and comprehensive series of county maps ever made. At the end of the year there had been approved 2,962 sheets covering 1,924 counties, approximately 70 percent of the total to be completed. Other series of maps to be drafted on the base maps show highway and other transportation systems, bus and truck routes, postal routes, school-bus routes, and traffic volume.

There has been an increasing public demand for these maps, and many requests from private agencies and individuals have been received by the States concerned. Arrangements have been made with the States to supply copies or complete sets to a number of Federal agencies, including the Library of Congress, the Soil Conservation Service, the Agricultural Adjustment Administration, the Farm Credit Administration, and the Bureau of the Census. These maps are also used by the Rural Electrification Administration which makes tracings from copies of maps furnished for their studies.

In cooperation with the Bureau of the Census, boundary limits around the settled areas of unincorporated urban communities of 800

or more population have been established by the planning surveys in 29 States. The maps will show these boundaries, which will be used in the 1940 census, making possible, for the first time, census reports for such unincorporated settlements.

Field surveys, which form the basis of the map work, and also an inventory of the present extent and condition of all rural roads have been completed in 43 States, covering an aggregate of 2,748,853 miles. In 3 other States, with an estimated road mileage of 133,258, the mileage inventoried to June 30, 1939, was 118,375, leaving only 14,883 to be completed.

The surveys include collection of data on sharp curves, steep grades, sight distances, and banking of road surface on curves, on the primary highways with the location and nature of critical restrictions. These data are assembled in two groups: (1) Nonmountainous roads having sight distance of less than 1,000 feet, curvature exceeding 6°, grades exceeding 5 percent; (2) mountainous roads having sight distances less than 650 feet, curvature exceeding 14°, grades exceeding 8 percent. These data will reveal critical sections of the highway system requiring early attention and, when correlated with traffic density and accident records, will indicate the priority that should be given projects in improvement programs. Nearly all of the field work and most of the initial tabulations have been completed.

In cooperation with the Association of American Railroads, pertinent facts relating to rural and urban grade crossings are being supplied which will be combined with data from a field inventory of the crossings and traffic counts to arrive at a priority improvement program. Most of the data to be supplied by the railroads have been received and await completion of the urban-crossing inventory. About half the field work has been completed.

Field work on the traffic surveys has been completed by all but 9 States. At 3,237 loadometer and pit-scale weighing stations, the weights of trucks, commodities carried, and other data were recorded for thousands of trucks, tractor-truck semitrailers, and trucks with full trailers. Information on the flow of weight over the highways will be obtained from the loadometer stations, while more detailed and precise data will be obtained at the pit-scale stations to determine loading practices as related to regulation and taxation. Information regarding the weights and dimensions of busses and number of passengers carried is also obtained at these stations. Large-scale traffic maps have been completed for all counties in 7 States, and active work is under way in the preparation of such maps in 15 other States which have submitted advance copies for approval as to form and method. State traffic maps covering the primary road system and important local roads have been completed in final form in 4 States and in preliminary form in 17 other States.

There are now installed 411 automatic traffic-recording machines, recording the number of vehicles passing hourly. The design of these units was originally conceived by the Bureau and later perfected by commercial organizations. Installed at strategically located points, these machines provide a long period record of traffic volume. Completeness of the records permits the determination of characteristic traffic patterns and factors with which to expand short-period counts to annual averages and to show minimum, average, and maximum traffic volumes.

Supplementing these permanently located machines and also making it possible to reduce the number of manual counts, a number of States are now using portable automatic recorders, most of which have been constructed according to plans developed by the Bureau in its studies of motor-vehicle performance.

The financial surveys, which include four closely related studies, consist of the collection and analysis of information regarding the ability of the State to finance the highway program. In the fiscal study, complete data on income, expenditure, and debt of the State and all governmental subdivisions such as counties, townships, municipalities, school districts, and highway districts have been collected for a typical 1-year period. These studies will indicate the importance of highway transactions in comparison with other activities such as general government, education, and public welfare. They will show the present source of highway funds and will indicate where and how these funds are spent.

The road-use studies provide information regarding the relative use of the rural highways and streets by the different classes of motor-vehicle owners resident in various rural and urban classifications. Summarization of these data obtained from approximately 650,000 personal interviews with vehicle owners and operators, when correlated with results of the fiscal study, will indicate the relationships existing between contribution to highways and the benefits derived through their use.

The motor-vehicle-allocation study, based on analysis of more than 3,300,000 questionnaires, shows the registered location of motor vehicles and the proportionate amounts of gasoline taxes and license fees paid by residents of cities, towns, and rural areas. This information will be used to determine the amounts that may be anticipated from such sources in the future.

The road-life study consists of an analysis of the life of various types of surfacing and roadway elements on the State highway system. Data from the records of State highway departments form the basis of actuarial studies which will indicate the average service lives that may be expected from the several types of highway surfaces as well as the other elements of the highways such as earthwork, drainage structures, shoulders, bridges, and guardrail. This information, supplemented by analyses of construction and maintenance costs and salvage values, will make possible reliable estimates of the amount and cost of highway replacement and construction that will be required each year in the future. The highway construction and reconstruction program may then be scheduled over a period of time to correspond with funds likely to be available in the future for highway purposes.

Information regarding land uses, present and potential, will be obtained from the Department's land-use-planning program now under way in most of the States and involving the participation not only of many Federal and State agencies but of farmers as well. This work will provide a classification of the best uses of land by small local areas and will permit highway plans to be more closely correlated with those for agriculture.

ECONOMICS OF TRANSPORTATION

Shortly after the inception of the highway-planning surveys, the Bureau materially augmented its studies of the economics of transportation. In the planning of highway systems for the Nation, the States, and the individual counties and communities, as must be done in the future, careful consideration should be given to the economic and social activities served and to be served. In determining the extent to which highway transportation is economically sound and defensible it cannot be considered apart from other modes or kinds of transport. The transportation problem as a whole must be carefully studied, utilizing such materials as are available from other official sources, the results of the highway-planning surveys, and other special studies and analyses.

The work on economics of transportation has involved the preparation for use by the cooperating States of tables presenting the essential data on population, agriculture, industry, mining, and trade in each county; tables and maps for division of the States into areas of similar economic characteristics for use in analyzing traffic-count data; percentage factors by counties based on population and economic data to provide the States with a factual basis for equitable allocation of Federal-aid secondary mileage among the counties, and critical analyses from the economic viewpoint of allocation proposals made by the States; and outlines for detailed study of individual counties and county analyses to demonstrate to the States the data available and their use in determining present and probable future road needs.

Studies of truck movement of commodities have been developed from the loadometer data in Franklin County, Ohio, Baltimore, Md., and truck movement to and from ports. A special study has been outlined and put under way on the relation between income and population (changes and trends) and motor-vehicle usage (registration, gasoline consumption, costs, and expenditures).

A detailed continuing study will determine the relation between industrial relocation, decentralization and other industrial changes, and the need and demand for transportation (kinds, amounts, length of haul, costs, rates, etc.). This is an intensive, comparative, and analytical study designed to show the relation between the various modes of transport; the changes in demands on the various transport agencies due to industrial and economic changes and shifts; the influence of changes and improvements in transportation facilities on population, industry, agriculture, trade, and employment; and the relative adequacy of various transportation agencies and how transportation planning may be used as a directive force in industrial development.

An important part of the work has been conferences with other organizations and individuals on transportation problems, recommendations as to additional statistical data needed, and the stimulation of research by others.

SAFETY RESEARCH

Studies in highway safety, initiated under authority of the act of Congress approved June 23, 1936, were practically completed. Although full reports on a number of research projects previously have been transmitted to Congress, several unfinished studies necessitated the continuation of the cooperative research with the Highway

Research Board through the year. Final reports on these studies, including particularly an investigation of the validity and utility of driver test clinics for identifying or indicating needed education of the accident-prone motor-vehicle driver, were in preparation at the close of the year.

MAINTENANCE-COST STUDIES

Agreements with the State Highway Departments of Connecticut and New Hampshire, and the Department of Public Works of Rhode Island for a study of highway-maintenance costs in relation to traffic volume were renewed for the fifth year's work. Traffic records for the fourth consecutive year were obtained for 33 sections of highway in Connecticut, 52 sections in New Hampshire, and 102 sections in Rhode Island. The annual cost of general highway maintenance for various items on each section is being kept by the States and detailed records on traffic are being compiled.

The objective of this study is to determine the maintenance costs for the different types of road surface in relation to the traffic carried and various other items. Due to nonperiodic or infrequent costs of maintenance incurred, no determinations can be made until the records have been kept for a period of at least 5 years.

HIGHWAY-CAPACITY AND VEHICLE-PERFORMANCE STUDIES

Data collected in the field studies conducted last year in cooperation with the Illinois highway-planning survey and in previous field studies were analyzed and the results published.

Studies of the performance of trucks on highway grades were continued. The studies so far have involved only new trucks, which were given exhaustive tests on two grades located on route U S 40 east of Baltimore. From the results of these tests it is possible to compute accurately the performance of a given vehicle on any given grade. The results will also be used to evaluate other less exhaustive methods of test. These methods include the acceleration method, dynamometer tests, and various performance meters. One of these methods will be selected to test a much larger number of used trucks typical of vehicles in service on the road.

Twenty-two vehicles have been tested thus far. Several manufacturers have furnished the trucks and in most cases the driver, and have also delegated an automotive engineer to inspect the work and offer advice. The Quartermaster Corps of the War Department has made available the facilities of the Holabird Quartermaster Depot, which include a gasoline supply, storage of trucks and equipment, dynamometer laboratory, and machine shop, and the Army automotive engineers have been available for consultation and assistance. The National Bureau of Standards has rendered considerable assistance in a consulting capacity. J. T. Thompson, of Johns Hopkins University, has also acted as consultant, and the university has furnished space and equipment for the analysis of field data. A complete description of the tests and the procedures involved were reported to the Highway Research Board in December 1938 and published in Public Roads, February 1939.

The development of satisfactory equipment for the detailed study of the movement of vehicles and of passing practices has been a difficult problem. These studies are made on a half-mile section of

highway and involve the measurement at 50-foot intervals of time and position of vehicles as they travel through the section. A new type of electrical road detector was developed, in which the electric contact is made by the displacement of air in a rubber tube laid across the roadway as a vehicle passes over it. Several miles of telephone and electrical cables were necessary, and six 20-pen time recorders were assembled in units to time and record graphically the impulses received from the road detectors.

Satisfactory field and office procedure has now been worked out in experimental tests, and arrangements have been made with interested State highway departments to cooperate in extensive field work during the coming year. At present, work is under way in Massachusetts and is scheduled in Illinois and Texas.

In the case of the study of lateral placement of vehicles on the highway, a similar development has taken place. Equipment has now been perfected and consists of a road detector to measure the lateral placement at 1-foot intervals, and a speed meter which records automatically the speed of each vehicle passing. With this equipment it will be possible to determine the lateral position assumed by various types of vehicles traveling at various speeds on tangents, curves, and grades.

An outgrowth of the experimental work on equipment has been the development of a simple and very satisfactory automatic traffic counter which utilizes the pneumatic road detector. An adaptation of the counter has also been made which permits the independent counting of vehicles traveling in each direction. By using a road detector consisting of several units, it is possible to segregate and record, by traffic lanes, vehicles traveling in either direction as well as the total traffic, a development that is particularly useful in city traffic surveys.

NATIONAL CONFERENCE ON STREET AND HIGHWAY SAFETY

Active cooperation with the National Conference on Street and Highway Safety was continued. Early in the year the committee on uniform traffic laws and ordinances of the conference met to revise the five acts of the Uniform Vehicle Code and the Model Traffic Ordinances. Extensive changes in acts II and V of the code necessitated printing a new (1939) edition of these two acts.

A meeting was held of the joint committee of the National Conference on Street and Highway Safety and the American Association of State Highway Officials to revise the Manual on Uniform Traffic Control Devices for Streets and Highways. The recommended changes were published as a supplement to the 1935 edition of the manual.

With the cooperation of the National Bureau of Standards and a prominent manufacturer of pigments, a new supply of color cards was prepared by the Bureau, showing the correct shade of yellow for highway signs as prescribed by the manual. Samples of the color have been furnished to all State highway authorities for use in purchasing standard paints and enamels.

AMERICAN ASSOCIATION OF MOTOR VEHICLE ADMINISTRATORS

With the beginning of the year, the Bureau of Public Roads with the Automotive Safety Foundation and the National Conservation Bureau undertook to cooperate more closely with the American Association of Motor Vehicle Administrators, in order to promote more effective measures for assuring greater safety on the highways and greater freedom for interstate traffic.

Cooperative work has been specifically directed toward improving motor-vehicle inspection, driver examination, and reciprocity among the States, with respect to drivers' licenses and registration.

A special group of investigators has been compiling the codes for motor-vehicle investigations and driver examinations, and it is expected that these will be ready for approval of the association and the Bureau following the annual meeting of the association in August.

The general trend toward compulsory motor-vehicle inspection conducted directly under the motor-vehicle administrations of the several States has made it desirable that effective and rapid methods of inspecting great numbers of vehicles be studied and devised, and so far as possible introduced into the several States in order to establish uniformity of requirements in the operation and efficiency of vehicles.

It is likewise desirable that more exacting requirements be adopted in the examination of drivers before granting permits to operate cars, and that these examinations be standardized and so far as possible made uniform with respect to methods and ratings in the tests of driver proficiency.

Both of these studies are fundamental to the development of the desired reciprocity among the several States with respect to the operation of motor vehicles.

In connection with the studies carried on to determine adequate methods of vehicle inspection, the Bureau and the association cooperated with the Society of Automotive Engineers in a series of brake tests which promise to be of great importance not only for the purpose of inspection of cars but in future brake design.

During the year, the Bureau took an active part in three of the four regional meetings of the association and intends to continue cooperating during the forthcoming fiscal year.

STATISTICAL RESEARCH ON ESTIMATING HIGHWAY-TRAFFIC VOLUME

As additional data on highway-traffic volume have become available from the highway-planning surveys, research on principles and methods of estimating traffic volume from short-time counts has been extended in several directions. The work is of importance because of the necessity of preparing traffic-flow maps for a great mileage of highway which must be based on many traffic counts. The duration and frequency of the counts should be held to the lowest practical minimum as a matter of economy.

A report on dispersion of highway traffic by time periods was made to the Highway Research Board, extending the analysis to hours of the day, days of the week, and months of the year, for the entire period of a year in each case. Study was also made of the variation in traffic by hours of the day for each month.

Traffic counts on 25 legs of 14 trunk-line crossings in Michigan, chosen as representative of traffic variation in that typical industrial State, are now being analyzed and studied. Counts by hours for a period of 1 year have been tabulated and are being analyzed. Extensive use of tabulating machines is making possible a thorough analysis of a large mass of data.

The problem of estimating traffic volume at low cost and with sufficient precision is now being attacked with a larger number of continuous counts from a wider selection of typical stations. There are now available continuous counts at 3 stations in Maryland on local, county, and State highways by periods of 5 minutes for an entire year. These data will make it possible to determine the shortest count that may be safely used in estimating traffic. The 315,360 counts of 5-minute periods at the 3 stations were obtained with automatic traffic counters, and the analysis is being made almost entirely by mechanical means.

RAILROAD-ABANDONMENT STUDIES

The examination of dockets and reports in the files of the Interstate Commerce Commission covering the abandonment of railroad lines throughout the country was completed, and the abstracting of currently issued abandonment reports was kept up to date.

The data abstracted from the dockets and reports were largely assembled by States, tabulated, mapped, and in general prepared for the use of this Bureau and State highway officials in studying the abandonment of railroad lines. As of June 30, 1939, 1,275 abandonment cases had been examined since the inception of these studies, involving 18,847 miles of railroad.

Beginning in March 1939, advance information concerning proposed railroad abandonment has been sent promptly to district engineers of the Bureau, upon the filing of abandonment applications with the Interstate Commerce Commission, thus assisting the field representatives of the Bureau in their consideration of requirements at grade crossings for signal devices or structural changes. Subsequently, uniformly arranged abstracts of the Commission's reports have also been sent the district engineers when abandonments have been allowed.

The same advance information has been supplied to State highway officials to aid in present planning activities, and to encourage their study of the causes for and effects of changing railroad patterns as they bear on the whole transportation problem, and the demand for highway transport.

PHYSICAL RESEARCH

Previous annual reports have mentioned the new laboratories on the Mount Vernon Memorial Highway near Washington, where the physical research work of the Bureau is to be conducted. The buildings have been completed and the installation of laboratory equipment and furniture was well under way at the close of the year. The activities of the Bureau at the Arlington Experiment Farm of the Department will be transferred to the new research station in the near future. The improved facilities for conducting a continuing research program and the assurance of a permanent location for field tests place this work on a much more satisfactory basis.

SUBSURFACE EXPLORATION

Study of various applications of the electrical resistivity and seismic methods of subsurface exploration to highway problems has been continued. A number of minor changes and improvements have been made in the seismic equipment tending to simplify electrical circuits, reduce weight, and better the performance.

In May 1939, in cooperation with the highway department of Iowa, a rather extensive investigation was made to determine the value of both the resistivity and the seismic methods of exploration for locating rock formations and gravel deposits as sources of road-building material. While the results of this survey will not be definitely known until more excavations are made at the places tested, the present indication is that both methods are useful in locating materials.

Several other Federal agencies are now making shallow explorations by the seismic method, essentially as developed by the Bureau, and the experience with it seems to be generally favorable. It is particularly adapted to reconnaissance surveys, and its use results in a great saving of both time and expense.

MOTOR-VEHICLE-IMPACT INVESTIGATIONS

Study of the relative elastic properties of concrete when subjected to comparable static and impact forces, applied by a vehicle wheel, has been actively pursued throughout the year. The special pendulum-type testing machine, described in the report for last year, and other equipment designed and built for this purpose have functioned well. This research is developing data of a fundamental character and the work is necessarily of a slow and painstaking nature. It constitutes an important part of a broad program of research, the aim of which is to rationalize the structural design of concrete pavements.

The data obtained are of sufficient scope to justify the issuing of a progress report at an early date.

MEASUREMENT OF ROAD-SURFACE ROUGHNESS

The degree of road-surface roughness is one of the major factors that determine the magnitude of the impact forces developed by motor vehicles.

This research has for its object the development of apparatus, instruments, and testing technique for quickly and reliably establishing an index of roughness for any road surface. There has been no universally accepted method for measuring the roughness of road surfaces in spite of the generally recognized need for such measurement.

The equipment that has been developed by the Bureau shows evidence of having reached a satisfactory state of development. However, thorough field trials remain to be made before it can be stated definitely that this equipment is ready to be offered for general use.

EROSION TEST FOR COATED CULVERT PIPE

The study of the erosion test for determining the quality of the bituminous coatings used on corrugated-metal culvert pipe has been continued. Experiments with both full-weight and reduced-weight erosive charges of cement-mortar cubes have been completed.

All data obtained, both in the cooperative check tests mentioned in previous annual reports and in the subsequent tests made by the Bureau, have been assembled and analyzed, and a report prepared.

The data indicate certain inherent deficiencies in the present method of test. The use of cement-mortar cubes appears to result in more consistent data than are obtained with other materials but does not overcome other undesirable characteristics of the test.

STRUCTURAL DESIGN OF CONCRETE PAVEMENTS

Work in this field of investigation has been continued along the lines described in previous annual reports. A more detailed study of the structural action of pavement slab corners has been found necessary. Because of climatic conditions, the work had to be done during the early summer months. It involved extensive strain measurements to determine the direction of critical stresses. A report on this special study is scheduled for the coming fiscal year, following the completion of the fifth report of the original series, mentioned in previous annual reports.

The supplementary study of dowel plate joints, mentioned in the last annual report, has been continued whenever favorable weather conditions obtained, and a considerable amount of valuable data has been accumulated.

An analysis has been made of the data obtained in the condition survey of the older concrete pavements in Michigan, a survey made in cooperation with the Michigan State Highway Department last year. The pavements examined ranged in age from 3 to 20 years, and their selection was based on the presence of factors, such as subgrade type, which might be expected to influence the pavement condition. The detailed data covering the history and present condition of 46 miles of selected pavement have been studied and analyzed, and a report is being prepared.

The construction of an experimental pavement in Indiana, in cooperation with the State Highway Commission, mentioned in the last annual report, was completed during October 1938. The purpose of this research project is to determine the desirability and economy of introducing longitudinal steel reinforcement to permit an increase in the length of concrete-pavement slabs. The slabs constructed in the experimental pavement range in length from 10 to 1,320 feet and the steel reinforcement varies correspondingly from a light welded fabric to an exceedingly heavy bar construction. The behavior of the different sections under the normal traffic conditions on a transcontinental highway and the climate of central Indiana will be observed in periodic surveys in which detailed measurements will be made on certain selected sections. Two sets of observations have been made. It is expected that a preliminary descriptive report of this project will be prepared for publication during the coming year.

STRUCTURAL DESIGN OF NONRIGID PAVEMENTS

Work on the complex problem of the structural design of nonrigid pavements has been directed principally toward the development of instruments for measuring the effect of static and moving loads upon plastic materials such as compose pavements of the so-called flexible type. Several different types of pressure-recording devices have been built and their characteristics studied. It is expected that the development of apparatus will be continued and that both field and laboratory experiments in pressure measurement will be started in the near future.

INVESTIGATION OF THE FATIGUE STRENGTH OF ARC-WELDED JOINTS

In investigating the fatigue strength of arc-welded joints the Bureau has been cooperating with the University of Illinois, the American Welding Society, and the welding research committee of the Engineering Foundation.

Engineers in this country have been slow to adopt the practice of welding in fabricating steel highway bridges because they have been uncertain about the behavior of welded connections, particularly when subjected to fatigue caused by alternating or pulsating stresses as occur in bridges. Because of this uncertainty, engineers have not taken advantage of the inherent economy in the use of welded structures.

A laboratory study of the fatigue strength of full-size welded connections is being made, and the results will be used to establish methods of design that will assure safe welded bridges.

A program of testing was drawn up by a committee representing the various interested parties, and testing at the laboratory of the University of Illinois has proceeded during the year. Significant results have already been obtained, and these results will be made available to engineers through publication in bulletins of the university.

This investigation will have a direct effect on future practice in bridge design and construction.

INVESTIGATION OF BRIDGE FLOORS

The investigation of bridge floors is being conducted cooperatively by the Bureau, the Illinois Division of Highways, and the University of Illinois.

In the past empirical rules have been used in designing highway bridge floors because of the lack of any rational method of analysis of stresses in floor systems. These rules are based upon very limited investigations and therefore many questionable assumptions have to be made in applying them. Uncertainties have been provided for by designs that may be overly conservative and which unnecessarily add to the cost of the structure.

Several years ago the Bureau made a start in the rationalization of the design of bridge floors by making an extended mathematical analysis of the simplest case—wide concrete slab simply supported on rigid supports and subjected to wheel loads. This has permitted a somewhat greater accuracy in the design of floors. However, the conditions in most floors do not correspond closely to the assumptions in this case. In order to arrive at a complete solution of the problem it is necessary to make theoretical analyses of the types of floor in use and then verify these analyses by experimenting with actual floors under load.

The cooperative work was begun in 1936. Theoretical analyses have been made of numerous designs of floors, and the results of these studies are now available in bulletins of the University of Illinois. The results of tests on small-scale plaster models and on one full-size bridge floor have also been published in bulletins of the university. Additional tests on full-size floors are now in progress.

The results of this investigation will have direct application to practically all modern highway bridges and to many other structural-design problems and will lead to more satisfactory structures.

INVESTIGATION OF SUPPORTING STRENGTH OF FLEXIBLE CULVERT PIPE IN EARTH EMBANKMENTS

The cooperative culvert investigation by the Bureau and the Iowa Engineering Experiment Station was continued. Observations of pipe deformations and fill settlements were made on culverts that had been constructed during the previous year. A theory of the action of flexible pipes in fills has been developed at the experiment station and comparisons between this theory and the actual behavior of pipe are being made. The purpose of the investigation is to establish, for various conditions of installation, numerical factors that must be considered in determining the strength of pipe required. Because of the large quantity of culvert pipe used in highway work, this investigation will have a direct value in the economical design of highways.

PORTLAND CEMENT

Much interest has recently been aroused among cement technicians regarding the possible effect on durability of adding small quantities of certain substances to portland cement during the manufacturing process. These materials, known as grinding aids, are used primarily to assist in the grinding of the clinker, and it is only recently that attention has been called to the possible effect of such additions on the quality of the cement. Some observers have felt that the beneficial effect of using a blend of portland and natural cement, such as was used in New York and to which reference was made in last year's report, may have been due to a grinding aid used in the natural cement. They believe that portland cement containing a suitable grinding aid would have produced the same results without the use of natural cement. Others believe that the improvement was due to the addition of the natural cement, as such, and that the same results would have been secured had the natural cement contained no foreign material. The various agencies interested in this problem are now cooperating in a series of laboratory and field investigations in an effort to develop the facts. Experimental roads containing cements with and without grinding aids have been constructed in four States, while in the laboratory tests are under way to determine in just what respects the physical characteristics of portland cement are affected by the presence of such substances.

There is a definite feeling on the part of many engineers that some of the troubles with concrete which have recently occurred may be due, in part at least, to a lack of durability in the cement. These engineers are firmly convinced that the so-called old-fashioned cement, which contained less lime than the average modern cement, produced a more durable concrete. Partly in recognition of this possibility, the cement manufacturers recently proposed an accelerated soundness test for cement known as the autoclave test. This test is supposed to insure cement entirely free from the so-called delayed unsoundness to which some of the concrete-road failures have been attributed. An investigation of this test has been under way in the laboratory for over a year. This work includes the testing of cements now being used in road construction, the place of use of the cement represented by each sample being noted in order that the results of the tests may later be correlated with service behavior.

MASONRY CEMENT

The efflorescence that is frequently observed on the surface of masonry walls, while not serious structurally, is objectionable from the standpoint of appearance. A study was begun last year in an effort to determine whether there is a relation between tendency toward efflorescence and the type of cement used, and also whether it is possible to control efflorescence through the use of certain chemicals that preliminary laboratory tests have shown to be effective. A 30-panel brick wall has been erected, using masonry mortars prepared with different brands of cement with and without the addition of the so-called efflorescence-retarding chemicals. Results of this study should be available during the current year.

AGGREGATES

Investigation of the Los Angeles abrasion test and the various procedures for determining soundness of aggregates are being continued. The possibility of modifying the Los Angeles test so that any size material may be tested is being studied. At present only the 1½- to ⅜-inch size can be tested, a disadvantage in the case of materials that are nonuniform in quality. The tests comparing the results of the Los Angeles test with the action of a 10-ton road roller, referred to in last year's report, have been completed, and a report is being prepared for publication.

CONCRETE

The program of tests begun several years ago, that had for its object the development of a satisfactory laboratory test for rating the efficiency of materials used for curing concrete, was partly completed, and a paper was published describing the procedure as well as reporting the results obtained with a large number of materials.

An extensive series of tests was initiated for the purpose of studying the volume-change characteristics of concrete. Experience in certain States has indicated a marked difference in service behavior of concrete roads that apparently is related in some way to the aggregates used. Failure is usually manifested by excessive expansion of the concrete after a few years' service. The tests are for the purpose of determining whether the tendency to excessive volume change is due to the nature or grading of the aggregate or to both. In all cases the materials meet the specification requirements now in force so that this study is of fundamental importance.

PAVING BRICK

The need for further information regarding the significance of tests for paving brick resulted in the construction last year of an experimental brick road in Ohio, in which brick from every plant in the State were used. This is a cooperative project, the Ohio State Highway Department, the National Paving Brick Association, and the Bureau participating. A complete series of tests, including many special tests not now used in specifications, is being made by each cooperating agency. The results will be compared later with the behavior of the pavement under traffic.

BITUMINOUS ROAD MATERIALS

As in previous years, investigations have been continued to determine the significant properties of bituminous materials and aggregates for bituminous road surfaces and to correlate these properties with their service behavior. Laboratory tests were made on materials for (1) compliance with given specifications governing the construction of certain roads, (2) standardization of test methods in cooperation with State highway departments and other technical organizations, (3) the modification and development of specification requirements, and (4) the determination of the suitability of new materials or new combinations of materials for use under various conditions. Periodic observations of selected sections of road, in which materials of known characteristics have been used, serve to correlate the results of laboratory tests with the actual service performance of these materials.

Investigations designed to verify accepted theories or to develop additional information on bituminous materials and mixtures are being carried on alone or in cooperation with the State highway departments and committees of technical organizations. Recent cooperative efforts have led to suggested changes in the grades of liquid asphaltic road materials of the medium-curing and rapid-curing types and in the specification requirements for the different grades, that will result in technical improvements.

Laboratory investigations of the physical and chemical properties of asphaltic materials, tars, and emulsions, and the behavior of surfacings containing them must be made continuously for informational purposes. These studies are always necessary because of the development of new sources of supply, changes in refining methods, and the introduction of new paving mixtures.

A very important phase of this work has been the recent laboratory examination of 40 asphalt cements of the 2 grades, 50–60 and 85–100 penetration, from representative refineries using both domestic and foreign crude petroleums. The test data have been assembled in a report for publication. The examination of the materials included not only tests commonly used in standard specifications but also many special tests that have been proposed. The results of this study indicate that the adoption of certain of the proposed tests would restrict the available supply of asphalt to a great degree by eliminating many asphalts that have given satisfactory service under severe traffic and climatic conditions.

Research on the behavior of bituminous materials under laboratory tests designed to produce accelerated weathering have been continued by exposing both the bituminous materials and aggregate containing them to the light, heat, and moisture conditions of a special accelerated weathering device. The possibilities of specifying the required behavior of films of bituminous materials of microscopic thickness are being studied.

Research on bituminous mixtures to determine their probable behavior under actual traffic has continued. Accelerated traffic tests on a small circular track and many of the mechanical strength tests have been employed to study the characteristics of bituminous surfacing mixtures and bituminous stabilized-base courses. Although bituminous materials have been used successfully in stabilized-base

construction, more exact information is needed as to the type and quantity of material required for given conditions, methods of incorporating the binder, and the details of laying and compacting the mixture.

Experiments with cotton fabric in highway construction are being continued. Fabric is being used as reinforcement in bituminous road surfaces, as reinforcement in bituminous ditch linings and spillways, and for the temporary protection of the seeded slopes of cuts and fills. A great deal of experimental work has been done with cotton fabric in bituminous surfacing. Twenty-four States, using fabric furnished by the Department of Agriculture, have reported the construction of 127 projects representing more than 350 miles of fabric-reinforced roads. These include various types of surfaces such as surface treatment, penetration, plant mix, and road mix. Reports are being received on the construction, maintenance requirements, and service behavior. Inspections were made of 81 projects in 15 States and included practically all types of bituminous surfacing in which fabric has been used.

Among these are the four special cooperative experiments constructed in Alabama, North Carolina, South Carolina, and Tennessee, which have received and are receiving more detailed study than is usually given to routine projects. These, as well as the other test sections, will be observed as long as required to establish definitely the economic worth of fabric thus used.

The laboratory study of asphalt cements that has been conducted cooperatively with the Minnesota State Highway Department and the University of Minnesota has been completed and a report prepared for publication.

SUBGRADE INVESTIGATIONS

Soil studies were continued along the lines described in former reports. They consisted of studies of laboratory test methods, studies of low-cost road surfaces placed on small tracks and subjected to destructive forces similar to those of traffic and nature, observations of experimental roads and embankments constructed in cooperation with the various State highway departments, and surveys of roads constructed of low-cost materials.

The Bureau's tests for determining the grading, plasticity, and related properties of soil indicative of the stability have been adopted as standard methods of test by the American Association of State Highway Officials and the American Society for Testing Materials. The demand from other laboratories for standard samples for use in making check tests to improve their technique and apparatus has continued.

Investigation was made of new apparatus for determining particle-size distribution of fine-grain soils. The apparatus utilizes a new principle of dispersion that eliminates objectionable features of the mechanical method now in use. Photomicrographic studies of the structure and formation of soil in its natural state and the effect of moisture content and admixtures on the soil fabric were begun. The research on the microchemical analysis of soil solutions reported last year has progressed and quantitative chemical analyses by spectrographic methods has received consideration.

A world-wide survey of soil-testing apparatus made in cooperation with the Highway Research Board contributed materially to the Bureau's progress in the soil-testing field.

Tests for the control of embankment and stabilized-soil road construction attained the status of standard methods, and correlation of the compaction characteristics with the structural properties of soil was begun. Satisfactory devices were developed for making direct shear and stabilometer tests and simplified procedures were developed for determining permeability and capillarity which disclose drainage characteristics and the possibility of frost heave of soil.

In the realm of soil mechanics, analyses utilizing the theories of elasticity and of plastic equilibrium were simplified to facilitate their practical application to the problems of highway construction. Reports of this work previously published were supplemented by one on the design of abutments and retaining walls and another on the considerations involved in the construction of embankments on soft undersoils. To facilitate the correlation of theory, field observations and laboratory-test data in relation to such problems, the work is to be extended to include studies of stress distribution by means of photoelastic equipment and models constructed with differently colored layers of earth.

To meet the urgent need for information on the moot question of the relative effect of surface tension exerted externally, and of colloidal phenomena acting within, on volume change, compressibility, compactibility, and stability of stressed earth masses at different moisture contents, the performance of soil and water mixtures was compared with that of the same soil mixed with other liquids that have greater and less surface tensions than water. Studies of the permeability of soil-bentonite mixtures made in cooperation with the United States Forest Service were continued.

In the field of soil stabilization, efforts were devoted to studies of special local materials, construction methods, tests for bituminous- and cement-stabilized soil, and the preparation of specifications.

Among the local materials studied with special reference to their suitability for use in base courses were the volcanic ash deposits of Arizona, certain topsoils in the Southern States, and crusher-run aggregates.

The experimental embankments, referred to in last year's report, have been constructed in Ohio and Indiana, and observations are being made of the performance of sections constructed by different methods.

Comparison of data furnished by the circular track tests, mentioned in last year's report, with road performance has demonstrated the value of the tests for determining quickly and at relatively small expense the serviceability of road-building materials. These track tests have been found to be an excellent tool in determining which laboratory tests, out of the many suggested, disclose most accurately the information required in the construction of stabilized-soil roads. Among the materials investigated by track tests are various mixtures of sand-clay, sand-clay-gravel, and crusher-run aggregates, with and without treatment with deliquescent chemicals, and soils of different types with admixtures of portland cement and the various types of bituminous binders.

Specifications for stabilized road surfaces, base courses, and embankments, based on the Bureau research in cooperation with the several State highway departments, have been adopted as standards of construction by the American Association of State Highway Officials and are being considered by the American Society for Testing Materials.

To provide adequate control of the construction of stabilized-soil surfaces, portable trailer laboratories fully equipped for the making of desired soil tests have been developed and will be placed in the field.

Courses of instruction in soil surveying and sampling, soil testing, and soil mechanics were held in the Western States during the winter months. Seven 1-week courses were presented. Included in the attendance at both day and night sessions were approximately 500 representatives of Federal bureaus, State highway departments, and universities.

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1939 . . . REPORT OF THE CHIEF OF THE SOIL CONSERVATION SERVICE

REPORT OF THE CHIEF OF THE SOIL CONSERVATION SERVICE, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
SOIL CONSERVATION SERVICE,
Washington, D. C., Oct. 28, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I present herewith the report of the Soil Conservation Service for the fiscal year ended June 30, 1939.

Sincerely yours,

H. H. BENNETT, *Chief.*

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INTRODUCTION

The influence of a billion acres of eroded or eroding American land is making itself felt today in the farm and ranch homes of the country. Ten years ago, few recognized the destructive power of erosion, or realized it was costing farmers at least $400,000,000 a year in the removal of soil fertility alone. Five years ago the Government, with the cooperation of farmers, was leading the fight against soil waste. Today farmers, with the assistance of the Government, are taking more and more of the initiative, and with a new weapon, the soil conservation district.

By June 15 of this year, farmers had organized 161 districts, covering 88,500,000 acres in 26 States, and this is no more than a beginning. The number will be increased. And since the district prom-

ises to play such an important part in the solution of one of the Nation's most pressing agricultural problems, its progress is worthy of considerable attention and study. What is happening in the Coosa River soil conservation district in Georgia illustrates in some measure what is being done, and what can be done, in districts in every part of the country.

THE COOSA, AN ILLUSTRATION

Some 50 miles south of the Tennessee line in northwestern Georgia, the Etowah and Oostanaula Rivers join to form the Coosa. Together, the Coosa and its 2 main tributaries drain water and soil from more than 2½ million Georgia acres—the land of 8 counties and parts of 10 others.

Here, when the first white settlers arrived more than a century ago, the mountain ridges, the rounded knolls, the slopes and valleys, were covered by a forest of oak and scattered pine. The Etowah, the Oostanaula, and the Coosa ran clear in the 1830's and 1840's, when those early comers started clearing the land and building their homes.

By circumstance and habit their agriculture was diverse. The limestone soils, covering so much of the section, produced thick, nourishing grasses. Livestock prospered. Crops included grain, corn, and cotton. From pine and oak came lumber and timber for boats and buildings. There were gardens and game and fish.

But subsequently northwestern Georgia became a land of white bolls and fiber. Cotton displaced corn, grain, grass, and livestock. Cotton displaced any thought of replanting oak or pine. Cotton filled the land, and the reaction of the land was quick.

Row after row of cotton, running up and down hill on the same fields every year, with the land bare during the winter months, brought sudden erosion to the highly erodible soil. By 1900, farms were being abandoned because of the severe soil losses. Gullies formed and spread. Within a short time a new land grew old.

Almost all the virgin timber had been cut, and more than half the area was entirely free of forest. More than half the area was used to produce crops and pasture, but of the cropland, about 43 percent had been so severely eroded that it had little value for tilled crops.

The Etowah, the Oostanaula, and the Coosa were running muddy with the vanishing capital of 13,000 farms when, in September 1935, 30,000 acres spreading fanlike to the southwest of Rome, Ga., were selected by the Soil Conservation Service, in cooperation with the Georgia Extension Service and the Georgia Experiment Station, for a large-scale field demonstration of modern erosion-control methods. This, the third project of its kind to be established in Georgia by the Soil Conservation Service, was named the Agate area, after the Agate community on the western boundary of the project.

Here, because soil, slope, erosion, climate, and other land use conditions were representative in almost every way of those prevailing on most of the farms in the adjoining counties, the objective was to help the farmers of northwestern Georgia, by an actual demonstration of the most advanced practices, to conserve their soil and improve their land use.

What the Soil Conservation Service found was reported a few months later by the project manager. On floods, he said:

> The records indicate that one flood exceeding 30 feet has occurred every 6 years for the past 80 years. Present data indicate that the floods are becoming more frequent. In the past 10 years, 10 floods have occurred; 2 during the winter of 1935–36.

On erosion, he reported:

> The lack of well-planned, systematic crop rotations, failure to observe sound farm-management practices, and the cultivation of excessively steep slopes have caused serious sheet and gully erosion. Sheet erosion has become extremely active on all slopes, while gully erosion has become more severe on the steeper slopes.
>
> A study of 12 reasonably representative farms consisting of a total of 1,800 acres indicates the following: Little or no erosion on 30 percent; moderate sheet erosion on 30 percent; severe sheet erosion on 35 percent; and deposition of soil material on 5 percent.
>
> Of the 1,800 acres, 53 percent is gullied, with frequent gullies occurring on 12 percent.

On farm economy, he said:

> The majority of the farmers depend on cotton as the cash crop . . . About 60 percent of these (287) farms are now being operated by tenants.

In March 1937, the Governor of Georgia approved the Soil Conservation Districts Act of the General Assembly, an act which authorizes farmers, after a process of petition, public hearings, and referendum, to organize soil conservation districts as administrative agencies of the State to conserve the soil resources of designated areas.

Promptly following this enactment, the Georgia Extension Service, and leading farmers in the northwestern counties of the State took the initiative in establishing such a district. In August 1937, 1,563 farmers voted for, and 356 voted against, creation of the Coosa River Soil Conservation District, the first soil conservation district in Georgia and the fourth in the United States. The district boundaries included all of five counties and portions of two more. In all, the district measured 1,457,843 acres.

Two supervisors for the district were appointed by the State Soil Conservation Committee, and 5 weeks later three others were elected by the farmers of the district. Forthwith the district went to work. The supervisors, aided by farmer committees, a committee appointed by the State committee, and groups representing the State Extension Service, State Experiment Station, and Soil Conservation Service, drew up a program and work plan which outlined what the district proposed to do, and how it proposed to do it.

The program, in part, specifically recommended an increase in cropland acreage, bringing into cultivation "the best 30 percent of the land now idle plus approximately 2 percent of woodland on gentle slopes." It recommended that about 10 percent of the present cropland, particularly steep and badly eroded areas, very erodible soil types, and soils unsuited to the production of field crops, be retired to other uses, principally to permanent hay, pasture, new forest, and wildlife. The work plan outlined the policies to govern the district in its cooperative work with other agencies; it presented samples of desirable crop rotations, terracing recommendations, and other methods of land treatment, as well as other methods and procedures to be followed by the supervisors "for effectuating the work of the district."

On the basis of the district's program and work plan, the supervisors sought the cooperation and assistance of the Department of Agriculture in carrying forward their schedule of operations. A memorandum of understanding outlining the individual and mutual responsibilities of the cooperative agreement, the first of its kind to be executed between the Department and a soil conservation district, was signed in December 1937.

At the close of 1938, the district supervisors reported:

> A large majority of the farmers within the district have a favorable attitude toward the program. Many do not at this time understand or think of complete farm planning from a conservation standpoint in accordance with the district's plan of work. The interest is in a portion of the farm or one or two practices or on a seasonal basis. Practically all farmers have a strong realization of the necessity for changing their system of farming, from the clean-tilled one-crop system to that of diversified farming, using a large percent of thick growing crops and establishing an adequate terracing system. "How can this change be made and live at the same time" is the main problem which the farmers and the district leaders are facing.

On June 30, 1939, the supervisors said:

> The farmers as a whole have a very favorable attitude toward the program of the district. Through demonstration farms, an appreciation of farm planning based on sound land use and considering the farm as a single productive unit is being obtained in most communities. The farmers are realizing and accepting more responsibility in the formation and execution of farm-conservation plans.
>
> The press, radio, businessmen and civic organizations are solicitous in determining ways and means by which they may be of assistance in promoting the interest of the district program.

Subsequently, the district and the Department of Agriculture entered into supplemental memorandums of understanding relating to the policies and procedures to be followed in making Soil Conservation Service equipment and planting materials, and Civilian Conservation Corps labor, equipment, and materials available to the district. As a result of these memorandums, the C. C. C. camp at Cartersville was assigned in the fall of 1938 to cooperate with the district.

By arrangement with the State Department of Vocational Education, vocational teachers within their respective school districts are aiding in individual farm planning. Specialists of the Extension Service are assisting supervisors in the development and revision of district programs and work plans. County agents have sponsored conservation meetings and tours of the demonstration project at Rome, participated as leaders in the county program-planning movement, and cooperated with local associations in determining priorities of farms for work and the routing of equipment.

The State Forest Service cooperated by organizing the Northwest Georgia Fire Protective Association, which has afforded county-wide protection in four counties of the district. In addition, this State Service is furnishing order blanks and envelopes to the supervisors for distribution to district cooperators, who will purchase seedlings under terms of their farm plans.

County governing bodies provide the supervisors with repair shops, inspection facilities, and storage for heavy equipment, as well as trailers for transporting such equipment within a county. Moreover, appropriations have been made in four counties sufficient to

maintain county fire-protection associations and fire-fighting equipment. The average county appropriation amounts to $2,000 a year, and is matched by funds of the State Forest Service, which cooperates in this work.

The Farm Security Administration responded to requests from all counties in the district for cooperation in planning work. In addition, Farm Security Administration cooperators were having their farms included in the work-priority lists, and had the help of supervisors in planning and establishing conservation practices.

In September 1938, the southern section of Paulding County, which previously had not been a part of the district, was included. This additional area comprised 73,502 acres and brought the total area of the district to 1,531,345 acres. By June 30, 1939, a referendum on the advisability of further expanding the district by 450,734 acres, to include all of Walker County except the city of La Fayette, and all of Cobb County except the city of Marietta, had resulted favorably

Thus, after a century, the land of northwestern Georgia drained by the Etowah, the Oostanaula, and the Coosa is being directed by the present owners toward uses more nearly like those prevailing before the advent of the cotton gin, and toward purposes vital to agriculture. The district states them clearly:

> Specifically, the purposes are to control erosion and to maintain and build up the fertility of the soil in such a manner that farmers may raise their standard of living.
>
> Generally, the purposes are conservation of the soil and soil resources of the district, and the control and prevention of soil erosion; and thereby to preserve natural resources, control floods, conserve soil water, prevent impairment of dams and reservoirs, assist in maintaining the navigability of streams, preserve wildlife, protect the tax base, protect public lands, and protect and promote the health, safety and general welfare of the people of the district.

These objectives, of course, are not peculiar to the farmers of northwestern Georgia. In every State, wherever erosion has taken place to a recognizable degree, farmers are becoming more and more cognizant of the immediate and long-time advantages inherent in proper land use and conservation of soil resources. Only because the cooperative conservation work in soil conservation districts, demonstration projects, and C. C. C. work areas gives farmers a greater opportunity for community enterprise and organization are they more articulate in these areas than elsewhere.

By presenting here the story of the development of the Coosa district, an attempt has been made to tell, by example, what has happened and what is happening in many another area of essentially similar history throughout the Nation. The succession of settlement, exploitation, and erosion has left its marks on more than half of the land of the United States. In different sections, certain details of the succession have been different; the original land cover may have been grass instead of forest, the predominating cash crop may have been corn or wheat instead of cotton, the topography may have been flat instead of rolling, and the annual rainfall may have been twice or half as much as that along the Coosa, but usually the essential elements remain basically similar:

1. The original protective cover on the land was removed during the process of settlement.

2. A cropping system was adopted that put clean-tilled crops like cotton, corn, and wheat on erodible hillsides, without proper rotation, and without seasonal cover crops for soil protection and soil building.

3. Cultivation up and down hill during the cropping season, followed by the vulnerable exposure of soil during the fallow season, established an interminable sequence of land misuse that invited and accelerated both wind and water erosion.

On the range, there was a variance from this pattern. Here the forerunner of erosion was not the plow, but the mouths of too many cattle and sheep, biting too close to the ground, too often, whether the season was wet or dry.

Today, across the farm and range lands of the country, some 282 million acres either have been ruined or severely damaged by soil erosion. On an additional 775 million acres the process of erosion is actively under way.

However, there is a new development. Within the last few years, soil and water conservation practices and a philosophy of considered land use have been applied over millions of acres. The soil conservation district has been created as a mechanism for the furtherance of conservation, and has taken its place alongside the soil conservation demonstration area in the movement against erosion. The conservation or wise land use type of farm plan has been developed. Another chapter in the history of American land has been started—a chapter of conservation.

THE GROWTH OF SOIL CONSERVATION

It seems desirable here to review briefly the steps that have been taken to develop an action program on the land that expresses the national view of soil and water conservation and the related land use adjustments. By earlier standards, these steps have been rapid and extremely significant. Their direction has been influenced to a considerable degree by a number of social and economic conditions which may not at first seem to have a direct relation to the problems of land use and conservation. That these steps were taken at all, however, can be attributed in large measure to the recognition in Government policy that soil erosion is a serious problem of national magnitude.

Although a number of erosion experiment stations were established by the Department of Agriculture in representative agricultural sections of the country in 1929 to carry on basic investigations, it was not until the fall of 1933 that direct attempts to deal with the erosion problem on any comprehensive scale were started. At that time the Soil Erosion Service was established as an emergency agency of the Department of the Interior, with funds made available by the Public Works Administration. Primary objectives of this organization were to begin a Nation-wide program of soil erosion control and to help relieve unemployment by putting men to work under the new program.

The agricultural extension services and experiment stations of several States cooperated in this program. So did many other State and Federal agencies. So did the Civilian Conservation Corps, which

at one time assigned approximately 500 camps to erosion-control work under the technical supervision of the Service.

In April 1935, Congress declared:

> That it is hereby recognized that the wastage of soil and moisture resources on farm, grazing, and forest lands of the Nation, resulting from soil erosion, is a menace to the national welfare and that it is hereby declared to be the policy of Congress to provide permanently for the control and prevention of soil erosion and thereby to preserve natural resources, control floods, prevent impairment of reservoirs, and maintain the navigability of rivers and harbors, protect public health, public lands and relieve unemployment * * *.

These were the opening lines of an act (Public, No. 46, 74th Cong.) which was approved by the President on April 27, 1935. The same act authorized the Secretary of Agriculture to establish "an agency to be known as the 'Soil Conservation Service', to exercise the powers conferred on him by this Act and may utilize the organization heretofore established for the purpose * * *"

Thus the problem of soil erosion was recognized in national policy. The Soil Erosion Service was transferred from the Department of the Interior to the Department of Agriculture, renamed the Soil Conservation Service, and enlarged to include those functions already existing in the Department of Agriculture having to do with the prevention and control of soil erosion.

The Soil Erosion Service had elected to carry out its erosion-control program through the medium of demonstration projects located in representative agricultural regions, on the premise that farmers over a considerable area surrounding each project would be able to watch the progress of the demonstration and profit by the solution of typical erosion problems. The average size of demonstration projects established by the Service was approximately 25,000 acres. The average size of work areas around C. C. C. camps assigned to the Service was 15,000 acres. Demonstrations of such size and in such number constituted a new venture in American agriculture.

New also, in practical application, was the reasoning behind the selection of project areas and the conduct of project operations. According to this reasoning, erosion is a natural force proceeding within natural boundaries, and as such, must be dealt with on a natural instead of an artificial basis. So the project boundaries encompassed complete watersheds or drainages, regardless of State and county lines. Further, it was reasoned, all previous experience had shown that no single, unsupported erosion-control measure provided effective erosion control on agricultural land, and therefore all adaptable measures should be utilized and coordinated to obtain the maximum possible degree of conservation. The new program included, in a coordinated approach, terracing, agronomy, woodland management, crop rotation, and all the other available vegetational and mechanical measures that would help prevent and control erosion.

Out of this approach emerged the basic physical principle on which the Service operates:

> The use of every acre of every field, pasture, and woodlot of every farm according to its individual adaptabilities; the treatment of every acre of every field, pasture, and woodlot of every farm according to its individual needs.

In turn, this principle formed the basis for what may eventually be regarded as one of the most important contributions of the demon-

stration program to American agriculture, the conservation land use farm plan. Briefly, this new kind of farm plan endeavors, on the basis of all available information, to plot the course toward maximum conservation of soil and water resources consistent with an adequate economic return from the farm.

For every farm included in the demonstration program of the Soil Erosion Service, such a plan was prepared by technicians of the Service in cooperation with the farmer. This meant that an advance schedule of operations was established for the first time in the history of several thousand farms. By looking at his plan, the farmer could tell the use of any given field on his farm over at least a 5-year period. He found that he was in a better position to gage his probable income. He found himself in a better position to discover the weak points in his farm operations—whether, for example, he was producing too much of one crop and not enough of another, or whether too much of his land was in cultivation and too little devoted to other uses. With this information, he found himself in a better position to make judicious changes in his farm operations and so more nearly approach the best possible land use.

The reasoning and principles of the Soil Erosion Service were continued and amplified in the Soil Conservation Service. New demonstration projects were established. Research work was broadened and intensified. The cooperation of all interested Federal, State, and local organizations was solicited, and usually obtained.

It became rapidly apparent, however, that the program of demonstration had its limitations. While the demonstration projects created interest in soil conservation and provided a source of practical erosion-control information, the sphere of influence of the projects did not normally extend much more than 50 miles beyond the project boundaries. In other words, beyond the 50-mile circle, there generally was no substantial conversion to soil conservation practices as a direct result of the demonstration.

Millions of acres throughout the country, however, were shown by surveys to be in acute need of soil conservation treatment. How was this need to be met? Were the demonstrations to be expanded until their spheres of influence joined? What were the alternatives?

Various possible solutions were studied, and out of the study came a broader understanding of the soil conservation and land use problem.

It became abundantly clear, for example, that behind the billion acres of American land damaged by erosion, there exists an array of social and economic circumstances responsible not only for the depletion of soil resources, but for other troubles of the American people as well. Deleterious farming habits brought down to the present day, economic exigencies, and imperfections in the agricultural system were recognized as prime reasons for land misuse. Logically, therefore, a solution of the soil-erosion problem would have to be developed, basically, around adjustment of those circumstances and influences impelling people to use land unwisely.

Also apparent was the need for some mechanism or avenue whereby the principles and tools of wise land use could be introduced and applied over most or all of the area requiring treatment. What was this mechanism or avenue to be? The job was obviously too large

and too expensive for the Federal Government to undertake alone, even if there had not been other disadvantages inherent in such a course of action.

THE SOIL CONSERVATION DISTRICT

Of all the possible alternatives, none offered as much promise of aiding successfully in the solution of the complex land problems as did the soil conservation district. It was local, flexible in size, democratic in formation; and it promised, in operation, the maximum active participation of farmers. It promised, moreover, to be the most effective mechanism for spreading conservation measures over substantial areas of the country in need of land treatment.

Beginning in 1936, the Department of Agriculture encouraged the enactment, by State legislatures, of laws permitting the formation of such districts. By June 30, 1939, 36 States had passed such laws and 161 districts had been established under their provisions.

By most State legislation on soil conservation districts, a State soil conservation committee is established. Usually the law provides that 25 landowners may petition this committee for the formation of a district. If the committee determines that the proposed district is in the public interest, it announces a public hearing on the question within the area under consideration. If the consensus of opinion expressed at the public hearing is favorable, the committee authorizes a referendum, and all owners and operators of lands within the proposed district may then vote for or against the district. If the vote is favorable, the State committee grants a charter, the district boundaries are officially recognized, and district supervisors are selected. Normally, 2 supervisors are appointed by the State soil conservation committee, and 3 are named by the landowners and operators of the district in a general election.

Through these elected supervisors, the people of the district are able, more effectively, to enlist the assistance and cooperation of governmental agencies and other organizations in the solution of existing social, economic, and physical problems within the district. Working together, more effective plans may be developed, more ambitious programs may be undertaken, and more actual work may be accomplished than would be possible through independent action.

This type of cooperative community enterprise, advantageous to the farmers or ranchers within a district, is proving helpful at the same time to a number of governmental agencies, because they are able, in many cases, to discharge their responsibilities more economically and completely through soil conservation districts than in any other way. At least for the present, they constitute the most promising avenue to Nation-wide conservation of many of our natural resources, and to Nation-wide improvement in the use of land.

The soil conservation district concept, however, cannot be regarded as completely new in American agriculture and government. Districts of comparative structure, but with different and relatively limited objectives, have been functioning in various sections of the country for many years. In certain arid and semiarid regions of the Western States, for example, irrigation districts have been operating for more than a score of years to sustain irrigation farming through the cooperative development and use of irrigation waters. In other

sections, drainage districts have been functioning to provide needed drainage for lands that would otherwise be too wet to farm. Wind erosion-control districts were established in the Panhandle section of Texas to combat wind erosion more effectively. Conservancy districts, with flood control as the primary objective, have been formed in a number of areas.

In a sense, the soil conservation district also is aimed at a specialized objective. It is charged with the development of a program to attain a better standard of living through wise land use and conservation of soil and water resources. To this end, it is given certain legislative authority which can be used, in a democratic way and if needed, to carry out its purposes.

But the district recognizes that conservation and wise land use cannot be achieved through the application of some simple formula or by the completion of some particular type of construction development. All experience to date points toward a broad attack, on social and economic as well as physical fronts, as the only means of arriving in the end at a type of land use so undeniably and demonstrably sound that it may be maintained permanently. Just as terracing alone will not provide adequate protection for steeply sloping cultivated fields, so conservation measures alone will not bring economic stability to the family operating a farm too small to produce adequate returns. In other cases, credit, better marketing facilities, more land, debt adjustment, zoning, or some other adjustment or a combination of them is an essential prelude to good land use and conservation.

At the same time, virtually all the evidence of research, demonstration, and experience, indicates that those active measures and adjustments that will promote conservation of soil and water resources will also go far toward the solution of social and economic problems. The problems of wise land use and conservation are bound together, in large measure, with a number of other problems of agriculture and industry. Each affects the others.

To cite a few examples, soil erosion increases the hazard of floods by increasing the speed of water run-off from agricultural lands. Soil conservation decreases flood hazards because the same methods used to conserve soil at the same time slow down the run-off of water that would contribute to floods. Soil conservation measures store water in the soil, and that additional water in the soil is a bulwark against drought. Soil erosion reduces crop yields per acre and accordingly may reduce farm income. Insofar as erosion cuts down farm income, it destroys investment and purchasing power. And insofar as soil conservation and wise land use increase farm income, investment and purchasing power are built up.

On the other hand, when farm income is decreased by a slump in the market price of farm products, it may lead the farmer to mine his soil in order to achieve by sheer volume of production the necessary income he could not obtain under a diversified, conservation type of farming. In turn, such mining of the soil has hastened erosion, and at the same time contributed to the creation of crop surpluses.

Growing farm tenancy has increased the possibility of erosion, for it is apparent that tenants and sharecroppers often have little interest

in the land or its future. Their interests, because of their circumstances, are immediate. At the same time it should be noted that attempts to win a livelihood from eroded farms often meet with failure, and the owners of eroded farms may be forced into tenancy.

The soil conservation district seeks to resolve, through a positive district program, such complexities and intricate relationships as these. The district seeks, through intimate knowledge of conditions within its boundaries, to plan the best possible course of action that will solve its problems. And wherever the resources within the district are inadequate to cope with the problem, it is in a position to look elsewhere to any appropriate available source for assistance. The district, therefore, becomes not only a mechanism for community self-inspection and self-treatment, but a community agent for enlisting outside aid.

Moreover, the district provides an opportunity for State and Federal agencies to coordinate effectively, at the community and farmer levels, a number of their own activities.

Coincident with the depression beginning in the early 1930's, and the accompanying drop in farm income and commodity prices, came a sharpened demand from farmers for practical assistance. To meet this demand and work toward basic agricultural adjustments believed necessary in the light of an altered economy at home as well as abroad, public action programs of vast significance were devised to bring immediate aid to the farmer, and through the farmer, to the Nation. These action programs, cooperative in nature, were aimed toward rural rehabilitation, restoration of an adequate farm income, wise use of basic resources, elimination of price-depressing crop surpluses from the domestic market, increased availability of credit, improved marketing facilities, and other objectives.

Inevitably the operations and effects of each of these programs influence the operations and progress of the others. To the extent that the programs are coordinated the common influence is beneficial; to the extent that programs proceed without coordination the common influence may be undesirable. One program operating independently, for example, might make loans to farmers in an area which because of its climate and the susceptibility of its soils to wind erosion, should not be continued in cultivation but retired to grass and grazing. The loans, however, would prolong this undesirable use of land and consequently retard the program for conservation and wise use of basic resources.

On the other hand, when programs are geared together, better results are almost invariably attained. In certain arid and semiarid sections of the country, for example, loans to ranchers for the development of water facilities on the range might not only help establish more economic operating units by increasing the carrying capacity of the range and providing supplemental feed to relieve the range, but also aid in soil and water conservation by permitting a more even distribution of grazing.

Because the soil conservation district endeavors to make a thoroughly comprehensive appraisal of its agricultural problems and objectives, and undertakes to develop as completely as possible a program leading to realization of these objectives, there is every likelihood that activities of public agencies in a district would proceed

in harmony and balance. Indeed, the introspection and comprehensive attack involved within the district framework would seem to assure coordination of effort and orderly progress toward predetermined goals.

The district, however, offers not only a ready opportunity for coordination of programs to avoid any possibility of stalemate in activities, but also a desirable area for the coordinate application of appropriate programs in the interests of achieving maximum benefits from such programs. Proceeding from the elemental premise that virtually all aspects of agricultural endeavor are closely related, and that progress in one field produces favorable reactions in related fields, then it is clearly advantageous to concentrate activities, insofar as this is feasible, in certain selected areas, such as districts.

Studies have shown that within each large geographic or cropping region of the country, such as the Great Plains or the Corn Belt, there are usually a number of sections in which specialized types of adjustment or development may be undertaken advantageously. In a dozen different localities within a large region, for example, it might be especially desirable to purchase land that is submarginal for cultivation and retire it to uses for which it is better fitted, such as grazing or timber production. There might be a hundred or more sections in which C. C. C. camps could be utilized effectively in the conduct of soil conservation work. Thirty or forty sections might have particular need for rehabilitation assistance. In some of the same sections, or in other ones, additional beneficial operations might be conducted.

Because of financial and other considerations, however, it is often impossible to undertake all the desirable work in all these sections. A selection of working areas must be made. But even so, it is entirely possible that work along one line will be carried on in one group of localities, the work along another line in another group of localities, and so on. Unless an effort is made to concentrate activities, no two or more fields of work may center in the same area.

It is acknowledged, however, that when work in a number of related fields is carried on simultaneously in the same locality, so that each supplements and implements the others, progress is greatly accelerated. The development of water facilities, for example, may in some localities make a direct contribution to the rehabilitation of needy families. It may also make a direct contribution to the conservation of soil, the restoration of wildlife, better use of farm or range land, and in some cases even to the maintenance of local Government functions. The purchase and development of land that is submarginal for cultivation may contribute to the same ends. So may the development of community forests. The foregoing combinations of adjustment and development work are, of course, not inclusive; the possible combinations are virtually unlimited.

The soil conservation district invites such a concentration of activities. It offers more than its basic program of district-wide soil conservation. It offers a community of farmers or ranchers who have demonstrated, by their initiative in organizing the district, a sense of responsibility and an active determination to solve their own problems, insofar as they are able, by local democratic enterprise. Around this nucleus, many problems may be solved.

Active participation of all the people is at once a basic principle and a basic aim of democratic government. By the same token, the active participation of farm people in the solution of farm problems is not only desirable but essential in a democratic country. The mere willingness to participate, or the passive expression of agreement in some plan does not always fulfill the democratic obligation. Individual and community understanding of local problems, the initiative to formulate local programs, and the resourcefulness and ability to carry them out, constitute the true fulfillment.

As the complexities of civilization have increased with each succeeding year, however, American society, as represented by the Government, has been obliged to broaden its scope of interest in the public welfare. At the same time, it has assumed a responsibility to maintain and strengthen the democratic processes. There is reason to believe that the soil conservation district provides an opportunity for at least a partial discharge of this responsibility. The people who have organized a district are apparently limited in their ability to assume and discharge local responsibility in certain fields pertaining to agriculture only by their opportunity to do so. If this is true, and there is as yet no evidence to the contrary, then it would seem fitting that the Government, insofar as it may, should make this opportunity available.

There is still another reason why it becomes desirable for the Government to cooperate with local soil conservation districts. The district promises, in many ways, to reduce the farm or unit cost in the operation of a number of agricultural programs, and thus permit wider utilization of available funds. The soil conservation program, for example, was of necessity intensive in application during its first few years. When the Soil Conservation Service established demonstration areas it was not only necessary to carry on elementary educational work in erosion control and plan the conservation operations but also to provide much of the labor and materials for those operations.

When a soil conservation district requests the cooperation of the Service, however, the principal assistance asked for is technical help in planning and laying out operations. Labor and materials become secondary considerations, for the district farmers themselves carry the major share of this burden. As a result, a greater portion of the funds allotted to the Service may be devoted to the employment of qualified technicians, and the greater number of technicians are able, in turn, to increase the extent of conservation by serving a greater number of farmers.

In short, there are a number of reasons why the district may appropriately become a preferred area, or focal point, for those public programs which are limited in the extent of their operations and cannot, because of various circumstances, function actively over large sections of the country.

At the same time it is desirable to recognize that the soil conservation district is still comparatively young and that it has certain definite limitations. The district, except in two States, has no taxing power or authority to contract a bonded indebtedness. Therefore, the district must rely to a considerable extent on the farmers and

landowners and on local, State, and Federal Governments for whatever assistance may be necessary.

Governmental aid may take the form of technical services, C. C. C. camp labor, special equipment, planting materials, or even financial assistance. Because of its financial position, the district is ill-equipped to employ independently the technical help so essential to the orderly prosecution of a district program. For the same reason, it is usually not in a position to purchase independently submarginal tracts of land, or some types of equipment that may be valuable for district-wide use, such as large terracing machinery. Accordingly, it seems apparent that for some time to come, governmental assistance along these and other lines may play an important part in the operation of districts.

Out of this cooperative endeavor may come a truly significant advance in American agriculture. The ultimate extension of the district idea is unknown, but its potentialities are clearly great. Even today it is apparent that a multiplication of districts, stretching from coast to coast and covering a substantial segment of the land in need of treatment, would be a long stride forward.

DEPARTMENT REORGANIZATION

Added to the development of soil conservation districts in more than half the States, the reorganization of the Department of Agriculture in October 1938 speeded progress toward better land use in the country.

By the reorganization, action phases of the physical land use adjustment programs on agricultural land, with which this report is chiefly concerned, were grouped together in the Soil Conservation Service. In addition, research activities in the fields of irrigation and drainage were transferred to the Service. Thus, for the first time, it became possible for the farmer to work with a single representative of the Federal Government in matters pertaining to erosion control, the farm part of flood control, water facilities, submarginal-land purchase and development, farm forestry, irrigation, and drainage. As a result of the reorganization, the way was also paved for simpler, more effective coordination of the physical land use adjustment activities of the Department with those programs concerned primarily with social and economic adjustments.

The Bureau of Agricultural Economics became the broad planning agency for the entire Department (while continuing at the same time to serve as the economic fact-finding agency); and accordingly it became possible, through this centralization of the program-planning function, to consider adjustments in physical land use in the light of other activities, and work with more assurance toward a single, integrated farm plan.

Establishment of the Agricultural Program Board, composed of the heads of the action agencies, the planning agency, and the directors of the Department, provided for a constant review of programs to bring out the collective appraisal of provisions in the programs by all the agencies concerned and to enable the individual members of the Board to keep in touch with developments in related fields.

Within the field of physical land use adjustment, the reorganization imposed new responsibilities on the Soil Conservation Service. Previously, its basic objectives had been erosion control, conservation of soil and water resources, run-off and water-flow retardation in aid of flood control, and the development of facilities in arid and semiarid sections of the country for water storage and utilization as an aid to wise land use. The reorganization enlarged Service objectives to include the development of farm forestry and the purchase and development of lands submarginal or not primarily suitable for cultivation, in order to correct maladjustments in land use.

The initial congressional appropriation for the farm-forestry program was made shortly before the close of the fiscal year, and details of policy and procedure relating to the cooperative conduct of the program have not been completed.

Under its broadened authority in the field of submarginal-land purchase and development, the responsibility of the Service has been extended, not only to the conservation of soil resources on private lands and restricted areas of public land, but to the administration and management of considerable areas of submarginal agricultural land acquired by the Federal Government through purchase.

As rapidly as possible, policies are being developed to govern the extent to which the Service itself will attempt to manage these acquired lands and the extent to which management will be turned over to other agencies. In some cases, it will be advisable to follow the latter course, especially where large areas of acquired land are best suited to use as parks, forests, wildlife refuges, grazing units, and so on. In other cases, it will be necessary to retain the purchased land in active agricultural use by private individuals, probably through a mechanism whereby those State and local agencies best able to administer the land over long periods would be given active management of the land. In a third category is the purchased land which the Service itself will continue to manage and administer.

More clearly defined criteria to govern future purchases of land are being developed, and steps have been taken to bring about the complete integration of the land-purchase program with the programs administered by the Service prior to the reorganization.

In the field of flood control, for example, careful consideration is being given the possible contribution of land acquisition to the flood-control objective in those watersheds where surveys are now under way.

In the demonstration projects of the Service there will probably be little, if any, immediate opportunity for land acquisition to contribute to the erosion-control and conservation objectives. In demonstration projects that may be established in the future, however, acquisition may play a beneficial part. Plans for future projects will carefully consider the possibility of acquisition.

Because of the relatively indefinite tenure of C. C. C. camps in any given location, the work areas of C. C. C. camps under technical supervision of the Service probably will not offer great opportunities for acquisition as a supplement to the conservation work.

In soil conservation districts, the possibilities of advantageous acquisition are considerably greater. Districts usually cover sizable

areas, and may include blocks of land which should be in public ownership, either Federal or non-Federal. At the request of district supervisors, the Service will assist in the formulation of district programs and work plans, including designation of lands which should be diverted to public ownership.

Under present authority, water facilities will be constructed or installed on federally owned lands only where actual use of the water will be on private or non-Federal lands. In those few cases where water facilities should be placed on federally owned lands in order to protect them and provide maximum benefit to private lands, it may be advisable to utilize the acquisition authority now available.

The usefulness of land acquisition in furthering programs administered by other agencies will, of course, be given careful consideration.

A NEW PHILOSOPHY

In a sense, the relatively rapid enactment of soil conservation district laws by 36 States, the development of action programs relating directly to conservation and land use, and the reorganization of the Department, may be considered reflections of a new philosophy that is developing across the country with respect to the land.

The inertia, or lack of interest of the individual in the condition of the land seems to be disappearing. Economic and physical forces, notably the depression, dust storms, and floods, have aroused and convinced many people that changes in our national land use pattern are necessary to national recovery and to the sustained welfare of agriculture. The way to national agricultural action has been opened and action programs are receiving intelligent cooperation from those who live and work on the land.

The recent developments may also be considered symbols of the new position which society has assumed in relation to the land. Not many years ago, it was generally conceded that the people as a whole had no interest in the use or destiny of privately owned land. Today, the land is generally recognized as a vital, national resource, and society's cooperative responsibility with the landowner in maintaining this resource has been established.

All the evidence of history supports the conclusion that a nation's soil is its most valuable and basic natural resource. To maintain itself permanently and ensure the foundation for a desirable standard of living, a nation must have an adequate area of productive land. As long as there was free land in this country, this fact received scant attention. Now that there is no more free land the conclusion reappears with new force; and in the growing trend toward conservation there is less inclination to ask whether or not the Nation can afford to conserve its land. The question now becomes: How shall this conservation proceed?

ECONOMICS AND CONSERVATION

ECONOMIC RETURNS

The general agreement that conservation of basic resources constitutes a valid national objective is based to a large extent on physical

considerations. In the final analysis, according to prevalent reasoning, these resources must be maintained almost regardless of the cost because they are the source of our food, clothing, shelter, fuel, and other basic requirements. And if the individual, because of economic pressures, cannot afford to conserve his land, then it becomes the responsibility of society to step in and assist him.

Through the conservation payments of the Agricultural Adjustment Administration and through various avenues of credit and finance, the Government is now attempting to relieve economic pressures on the land. In sections of the country where erosion has already stripped of most or all of the topsoil, and in those sections where the land was unproductive to begin with, this type of assistance has been particularly valuable. It has not only helped relieve distress, but has furthered conservation and better use of the land. Even in areas where erosion has made no appreciable headway as yet, and where the land continues to be productive, stimulants such as conservation payments have been effective in spreading conservation. And between these two extremes of good and poor land, economic assistance from the Government has influenced thousands of other farmers in need of help to adopt conservation practices.

It is a fallacy, however, to assume that soil conservation is invariably a money-losing venture, and that every farmer who adopts conservation measures is subject to financial losses. Studies in different parts of the country, although limited in their coverage, have indicated the opposite to be true. The Iowa Agricultural Experiment Station, for example, recently made public the results of a soil conservation study undertaken in the southern and southwestern sections of the State. In these two sections 2,190 farmers operating more than 348,500 acres were cooperating with the Soil Conservation Service in an attempt to control erosion on their farms.

According to Iowa Agricultural Experiment Station Bulletin No. 381, which reports the results of the study among a substantial sample, but not all, of these cooperators, 55 percent of the farmers interviewed stated that the productivity of their farms had already been increased by the Soil Conservation Service program, 92 percent believed that the productivity would be increased in the next 3 years, and 95 percent believed that it would be increased in the more distant future. The bulletin says:

> Practically all farmers stated that the program had increased the value of their farms, and the average increase reported was $5.44 per acre.
>
> According to farmers' reports, labor requirements were unaffected on over half the farms by terracing, strip cropping or contouring; more farmers reported an increase in labor requirements on terraced fields than on strip cropped or contoured fields.
>
> On strip cropped and contoured fields, reports show a decrease in tractor fuel requirements; similarly, contouring made work easier for horses.

Too much of our popular thinking takes the point of view that conservation is desirable, but costly to the individual. Generalities of this kind impede the progress of conservation and better land use, and in so doing, probably cost a great many farmers thousands of dollars each year.

Soil conservation and other measures comprising wise use of land may be applied in varying degrees and under a wide variety of physical and economic circumstances. The results, in turn, will vary

according to the degree of application and the particular circumstances under which they were applied. Just as there is no uniform set of farm conditions, so there is no uniform set of results which can be expected to follow on every farm after the application of conservation measures.

Conservation practices and other measures of improved land use have in some sections of the country brought immediate financial returns to the farmers who adopted them. In the Duck Creek watershed near Lindale, Tex., for example, 40 farms cooperating in the demonstration program of the Soil Conservation Service had an average farm income 101 percent greater than that of 20 noncooperating farms in the same watershed during the 4-year period, 1935–38. The average farm income for the 40 cooperating farms was 20.8 percent greater than on the 20 noncooperating farms in 1935, the first year of the program in that area. It was 75.9 percent greater in 1936, 125.6 percent greater in 1937, and 1,800 percent greater in 1938. Over the same 4-year period, the average labor earnings on the cooperating farms were 80 percent greater than those of the noncooperating farms. With respect to soil, topography, erosion, and type of agriculture, these farms were markedly similar, so that definite financial benefits are shown by the conservation program.

Although immediate and striking advantages from the application of conservation measures appear more prevalent in the Great Plains than elsewhere, because the presence or absence of water in the soil in that region almost always makes a pronounced difference in the crop yield, similar results in virtually every section of the country can be cited.

All this is no argument that conservation measures invariably bring an immediate financial advantage to the farmer who adopts them. It is a report on observations and data collected by the Soil Conservation Service during the last 5 years which indicate that on thousands of farms and ranches the application of soil and water conservation measures and other practices of wise land use may reasonably be expected to result in immediate financial returns, and certainly would cause no losses.

More information on the economic results of soil and water conservation, farm by farm, and region by region, is one of the pressing needs with which we are now faced. At the earliest possible opportunity, the facts should be assembled. Meanwhile, the mere absence of comprehensive statistical analyses and regional summaries is no refutation of the existing evidence, isolated and incomplete as it may be, that adoption of conservation measures can in numerous instances and over substantial areas result in immediate economic advantage to those who adopt them.

CONSERVATION AND CASH CROPS

In many though not all sections of the country, the extension of conservation measures and greater consideration of land use would undoubtedly strike a severe blow at the single cropping system. The practice of planting an entire farm to a single cash crop is usually hazardous in terms of soil resources as well as economics, and accordingly the complete farm conservation plan, as it is known

and developed today, almost invariably calls for diversification of crops.

To offset reduction in the acreage of the single cash crop, the plan normally provides for an adequate but limited acreage of several cash crops, and supplemental farm income from other sources, perhaps from eggs, poultry, dairy products, truck crops for the local markets, woodland products, or farm wildlife, depending on the individual circumstances. There have been occasions, as a matter of fact, where the supplemental income provided under the plan has exceeded the income from the cash crop under the original type of farming operation.

FARM SELF-SUFFICIENCY

Conservation of land implies care of land. It demands intimate knowledge of soils and fields, woods and pastures, slopes and susceptibility to erosion. It tends to develop a personal attachment to the land, and to the home that goes with it. The man who devotes months of thought and effort to nursing a gullied field back to health and production is not likely to value his work, or that field, cheaply. Similarly, the new cover crops he has planted, the threatening gullies he has plugged, the terraces he has built and maintained, and the new crop rotations he has adopted, are all inclined to sustain and kindle interest in the farm.

More often than not, the conservation farmer has improved farm conditions for poultry and livestock by providing more ample and more nutritious feed. Also, as part of his conservation plan, he is likely to have a farm garden. He is not so likely to buy his meat and potatoes, his milk, eggs, beans, and tomatoes from the grocery store in town. As a corollary of his conservation operations, his farm tends to be self-sufficient, at least in furnishing food for the farm family.

The conservationist, be he farmer, industrialist, student, or technician, is likely to have a love for the land, a personal conviction that the family farm home should be maintained and strengthened as an American institution, and that except under unusual circumstances, the farm should be self-sufficient insofar as the farm family's own food requirements are concerned.

By some, these may be considered intangibles of debatable value and of little practical relation to soil conservation and wise land use. Yet intangibles such as these, in the minds of men and women on the land, are a potentially powerful voice in support of conservation.

THE YEAR'S WORK

At the close of the fiscal year, the Service had carried on work in approximately 900 research, demonstration, land utilization, and watershed projects, S. C. S. nurseries, C. C. C. camps, water facilities areas, and soil conservation districts. These work units were located in 47 States and Puerto Rico, and covered more than 200 million acres (table 1). In these projects, camps, areas, and districts more than 22 million acres of land in private ownership or under lease to farmers and ranchers had been placed under cooperative agreements, and the owners were using operations plans that had been prepared by

Service technicians. On an additional area of 26 million acres of public land, all but one-half million being located within watershed and land utilization project areas, Indian reservations, national forests, and grazing districts, the Service had working agreements or operated under detailed plans. Approximately 81,500 cooperators were represented in the Service operations on private land (table 2).

Soil Conservation Service technicians had been active in cooperating with other bureaus and agencies in developing plans for S. C. S.—Extension Service demonstration farms, Farm Security Administration farms, water facilities projects, Indian reservations, national forests, grazing districts, roadside erosion-control projects, and others. More than 3,000 of these plans, covering 19,622,000 acres, had been developed by Service technicians cooperating with other bureaus and agencies. Table 2 gives the number and acreages for each of these cooperative efforts by kind of work unit.

The changes brought about in the utilization of each acre of land on farms and ranches where detailed operations plans were prepared are of interest. They were the results of planning the farms or ranches to include balanced crop rotations, additional acres for hay and other feeds that allow for better rotation, control of grazing and the use of pasture lands, exclusion of grazing from woodlands, provision for additional woodland acreage and for wildlife, and other changes for better farm and range management. More than 957,000 acres of land formerly in cultivation were planned for other uses less conducive to erosion, a reduction of approximately 14 percent in the total cultivated acreage. Permanent hay land was increased by 347,782 acres, or approximately 150 percent. Additional acreages were provided for pasture and range, and 334,994 acres were added to farm woods. Special areas covering 30,625 acres were provided for wildlife. Table 3 shows the land use changes on these farms and ranches.

The establishment of soil conservation measures through the combined efforts of the Service, cooperating farmers, and cooperating agencies developed to such an extent that all equipment available to them was in continuous use. Table 4 shows the extent of soil conservation measures in all work areas.

Tables 1, 2, 3, and 4 give the extent and principal accomplishments of the Soil Conservation Service, cumulative to June 30, 1939.

TABLE 1.—*Number and area of work units, by States and regions, within which the Soil Conservation Service was working or cooperating, as of June 30, 1939*

Region and State	Research projects		Nurseries		Watershed and demonstration projects		Land utilization projects		C. C. C. camps		Soil conservation districts		Water facilities areas		Total
	Number	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*
Region 1:															
Connecticut					1	72,000	1	55,687							2
Delaware					1	45,210	1	15,320	2	300,000					4
Maine					1	30,000	1	19,189							2
Maryland	1	1,698	1	40	2	66,730	2	199,613	6	550,000	1	180,000			13
New Hampshire															
New Jersey	1	100			3	71,190			3	75,000	3	313,982			10
New York	2	344	3	205	3	205,230	4	254,196	6	200,000					18
Pennsylvania	1	100	1	94	5	273,926	2	85,706	7	300,000					16
Rhode Island							1	13,538							1
Vermont					1	65,250									1
West Virginia					2	180,750	1	11,600	6	200,000					9
Total	5	2,242	5	339	19	1,010,286	13	654,849	30	1,625,000	4	493,982			76
Region 2:															
Alabama			1	181	4	202,879	3	146,008	9	325,000					17
Florida					2	37,940	4	831,147			1	250,000			7
Georgia	1	981	1	140	5	253,333	3	255,164	9	400,000	8	9,064,471			27
Mississippi			1	90	6	327,396	2	147,686	11	450,000	9	3,500,720			29
North Carolina	1	365	1	700	8	492,258	2	187,488	15	600,000	6	4,911,280			33
South Carolina			1	185	6	282,795	3	169,426	10	375,000	4	5,515,360			24
Virginia			1	183	4	291,800	3	97,520	10	350,000	2	1,500,000			20
Puerto Rico					1	2,231,040									1
Total	2	1,346	6	1,479	36	4,119,441	20	1,834,439	64	2,500,000	24	24,741,831			158
Region 3:															
Indiana			1	62	3	92,799	2	98,564	14	1,775,000					20
Kentucky			1	66	3	83,880	3	206,103	12	750,000					19
Michigan			1	107	2	70,780	1	50,908	1	25,000	2	275,000			7
Ohio	2	1,294	1	204	5	260,444	3	81,520	18	2,225,000					29
Tennessee					2	64,829	4	105,280	6	275,000					12
Total	2	1,294	4	439	15	572,732	13	542,375	51	5,050,000	2	275,000			87
Region 4:															
Arkansas					7	326,245	7	286,307	12	450,000	12	5,301,740			38
Louisiana			1	109	6	226,941	2	32,550	16	1,250,000	8	7,788,465			33
Oklahoma	1	260	1	119	9	490,822	2	54,529	21	750,000	16	8,845,909	5	1,960,080	55
Texas	4	2,698	1	89	9	517,451	1	25,040	23	825,000			10	10,791,680	48
Total	5	2,958	3	317	31	1,561,459	12	398,426	72	3,275,000	36	21,936,114	15	12,751,760	174

TABLE 1.—*Number and area of work units, by States and regions, within which the Soil Conservation service was working or cooperating, as of June 30, 1939*—Continued

Region and State	Research projects		Nurseries		Watershed and demonstration projects		Land utilization projects		C. C. C. camps		Soil conservation districts		Water facilities areas		Total
	Number	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*	*Acres*	*Number*
Region 5:															
Illinois	1	450			3	214,081	2	47,459	24	1,850,000	1	18,158			31
Iowa	1	200	1	132	5	195,073	1	1,901	21	1,425,000					29
Minnesota			1	203	4	113,882	2	1,774,080	9	300,000	1	54,120			17
Missouri	2	620	1	273	4	231,397	2	41,166	21	1,575,000					30
Wisconsin	1	160			3	150,289	4	376,184	13	525,000	2	75,150			23
Total	5	1,430	3	608	19	904,722	11	2,240,790	88	5,675,000	4	147,428			130
Region 6:															
Colorado					4	421,560	4	1,365,384	8	450,000	4	1,546,097	2	2,048,000	22
Kansas	1	210	1	130	4	246,257	1	479,775	13	725,000	1	411,520	2	1,274,240	23
New Mexico					2	99,520	2	298,624			3	710,000	1	147,200	8
Oklahoma					1	33,920	1	85,452					2	2,677,120	4
Texas	1	1,627	1	120	5	248,170	7	305,626	4	550,000	1	6,807,593	1	2,496,000	20
Total	2	1,837	2	250	16	1,049,427	15	2,534,861	25	1,725,000	9	9,475,210	8	8,642,560	77
Region 7:															
Montana					2	72,239	3	10,536,503	1	50,000			3	713,600	9
Nebraska	1	233	1	80	3	104,434	1	510,080	11	600,000	4	258,964	1	1,171,000	22
North Dakota			1	398	2	100,280	3	2,077,327	1	275,000	5	1,746,880	2	1,183,800	14
South Dakota			1	80	3	238,600	4	1,503,960	4	175,000	5	960,854	2	831,700	19
Wyoming			1	5	2	2,377,573	1	1,139,300					4	1,816,400	8
Total	1	233	4	563	12	2,893,126	12	15,767,170	17	1,100,000	14	2,966,698	12	5,716,500	72
Region 8:															
Arizona			1	78	3	11,555,935			3	(1)			2	384,000	9
Colorado									2	50,000	1	266,512	2	1,011,200	5
New Mexico	1	8,000	1	1,400	8	43,264,320	3	531,080	12	(1)	1	1,200,000	2	753,600	28
Utah					2	208,640	2	678,330	5	175,000	6	1,174,500	2	539,500	17
Total	1	8,000	2	1,478	13	55,028,895	5	1,209,410	22	225,000	8	2,641,012	8	2,688,300	59
Region 9:															
Idaho					2	148,280	1	353,280	4	175,000			1	100,000	8
Oregon			1	54	3	112,320	2	653,210	4	975,000			2	502,000	12
Washington	1	200	2	318	2	82,950	1	546,580	6	200,000			2	441,600	14
Total	1	200	3	372	7	343,550	4	1,553,070	14	1,350,000			5	1,043,600	34

Region 10:															
California			2	65	8	248,870			8	275,000			3	320,000	21
Nevada					2	114,990			1	75,000	7	6,423,680	1	500,000	11
Total			2	65	10	363,860			9	350,000	7	6,423,680	4	820,000	32
Grand total	24	19,540	34	5,910	178	67,847,498	105	26,735,390	392	22,875,000	114	69,100,955	52	31,662,720	899

[1] These areas included in watershed projects.

Gross acreages represents areas within which the Service had concentrated its major research and operation activities. In the case of C. C. C. camps, however, it represented the acreage worked in abandoned camp areas and an estimate of the maximum acreage to be worked in active camp areas. The C. C. C. gross acreage also includes 7,350,000 acres benefited by the work of drainage camps, of which 38 were operating as of June 30. Inasmuch as work unit areas overlap in a number of instances no total for all areas is shown.

TABLE 2.—*Total plans prepared to date by Soil Conservation Service technicians in areas within which the Service was working or cooperating, as of June 30, 1939*

Type of plan	Demonstration projects [1]		Western watershed projects		Land utilization projects	
	Number	*Acres*	*Number*	*Acres*	*Number*	*Acres*
Individual farm and ranch	25,099	3,738,412	1,039	5,588,105		
Soil Conservation Service-Extension demonstration farms	2,044	1,242,378	18	144,160		
Farm Security Administration farms	253	344,452	6	201,835		
Roadside-erosion control	100		6			
Water facilities	337	206,436	8	2,912		
Indian reservation			21	17,149,653		
National forest			13	147,293		
Grazing district						
Other public land			22	456,097	105	7,460,395
Other types	331	56,227				
Total	28,164	5,587,905	1,133	23,690,055	105	7,460,395

Type of plan	C. C. C. erosion [2] camps		Soil conservation districts		Total	
	Number	*Acres*	*Number*	*Acres*	*Number*	*Acres*
Individual farm and ranch	45,237	8,950,792	6,916	1,845,958	78,291	20,123,267
Soil Conservation Service-Extension demonstration farms					2,062	1,386,538
Farm Security Administration farms					259	546,287
Roadside-erosion control	360				466	
Water facilities					345	209,348
Indian reservation	1	120,000			22	17,269,653
National forest	3	7,582			16	154,875
Grazing district	5	55,037			5	55,037
Other public land	14	551,950			141	8,468,442
Other types					331	56,227
Total	45,620	9,685,361	6,916	1,845,958	81,938	48,259,674

[1] On or out from project.

[2] C. C. C. erosion camps have worked on an additional 2,144,768 acres located in demonstration projects, watershed projects, and soil conservation districts. These acreages are included in the totals shown for demonstration projects, watershed projects, and soil conservation districts.

Plans in demonstration and watershed projects, C. C. C. erosion camps, and soil conservation districts are cooperative agreements.

Plans in land utilization projects are in the form of detailed operation plans.

Plans on public lands are considered as working agreements.

Plans for Extension-S. C. S. demonstration farms are individual farm plans prepared in cooperation with State agricultural extension services.

Other types of plans include State and county institution farms.

TABLE 3.—*Land uses before and after planning for all farms and ranches for which detailed land use plans have been developed by Soil Conservation Service technicians, to June 30, 1939*

Land use	Demonstration projects		Western watershed projects	
	Before planning	After planning	Before planning	After planning
	Acres	*Acres*	*Acres*	*Acres*
Cultivated	1,981,580	1,705,448	60,412	59,899
Permanent hay	60,143	157,704	5,943	8,943
Orchard and vineyard	28,515	29,614	162	176
Pasture and range	1,047,624	1,166,676	7,707,428	7,705,016
Forest, range, and wooded pasture			371,287	371,185
Woodland	523,652	629,435	31,127	31,466
Wildlife		10,840		
Idle and miscellaneous	203,818	145,615	63,432	63,106
Total	3,845,332	3,845,332	8,239,791	8,239,791

TABLE 3.—*Land uses before and after planning for all farms, etc.*—Continued

Land use	C. C. C. erosion camps [1]		Soil conservation districts		Total	
	Before planning	After planning	Before planning	After planning	Before planning	After planning
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Cultivated	4, 129, 942	3, 519, 491	733, 653	663, 371	6, 905, 587	5, 948, 209
Permanent hay	146, 949	350, 621	23, 599	67, 148	236, 634	584, 416
Orchard and vineyard	37, 097	40, 972	10, 522	10, 027	76, 296	80, 789
Pasture and range	3, 617, 944	3, 933, 258	638, 399	766, 677	13, 011, 395	13, 571, 627
Forest, range, and wooded pasture	3, 413	4, 308	80, 305	22, 633	455, 003	398, 126
Woodland	1, 153, 524	1, 345, 372	234, 493	271, 517	1, 942, 796	2, 277, 790
Wildlife		16, 263	264	3, 522	264	30, 625
Idle and miscellaneous	417, 698	296, 282	124, 723	41, 063	809, 671	546, 066
Total	9, 506, 567	9, 506, 567	1, 845, 958	1, 845, 958	23, 437, 648	23, 437, 648

[1] C. C. C. erosion camps have worked on an additional 2,144,768 acres located in demonstration projects, watershed projects, and soil conservation districts. These acreages are included in the totals shown for demonstration projects, watershed projects, and soil conservation districts.

Land use and conversion figures represent only those areas for which detailed land use maps have been prepared.

TABLE 4.—*Status of soil conservation work under programs in which the Service had either directed or cooperated, as of June 30, 1939* [1]

Practice	Before planning	After planning	Accomplished June 30
Field border strips—linear feet		1, 974, 918	1, 639, 064
Woodland border strips—do		775, 210	431, 713
Contour furrows and ridges—acres		1, 163, 381	673, 279
Controlled grazing—pasture or range—do	4, 743, 558	10, 864, 651	
Animal units—number	596, 340	548, 598	
Cover crops and crop residues—acres	1, 336, 974	2, 402, 116	
Diversions—linear foot			35, 518, 598
Drainageways—do			28, 910, 615
Fertilizing—acres			175, 016
Rotations approved—do	997, 125	5, 192, 142	
Springs and wells developed—number			3, 004
Sewerage systems—do			264
Stream bank protection—linear foot			14, 400, 012
Strip cropping—acres	26, 418	2, 065, 539	954, 820
Structures, building, permanent—number			1, 263
Structures, building, temporary—do			1, 013
Fencing—miles			33, 563
Firebreaks—do			6, 803
Farmstead obliteration—number			4, 833
Irrigation-system treatment—acres			5, 952
Liming—do			100, 914
Planting pasture and range—do			739, 578
Plantings, woody—do			508, 095
Do—trees			625, 363, 529
Structures, water storage—number			7, 006
Do—acre-feet			147, 116
Structures, other types, permanent—number			421, 399
Structures, other types, temporary—do			3, 837, 966
Telephone lines—do			357
Terracing—acres	357, 452	2, 669, 186	1, 569, 370
Water spreading—do			403, 617
Woodland improvement—do		606, 348	557, 221
Contour cultivation—do	900, 236	4, 333, 418	2, 713, 794
Drainage work:			
Clearing ditches—miles			7, 407
Clearing levees—do			440
Ditches, excavated—do			4, 328
Levees rebuilt—repaired—do			146
Leveling spill bank—do			1, 511
Tile drains repaired—rebuilt—do			269
Structures repaired—rebuilt—number			3, 542

[1] Include the major items of work accomplished by all work units in establishing a soil conservation and land use program on areas for which plans have been prepared.

LOOKING AHEAD

THE DIRECTION

Unquestionably, the last 5 years have witnessed the most far reaching strides toward soil conservation and better land use in the history of the country. By comparison with the past, progress has been both rapid and comprehensive. The new partnership of farmer and Government in action programs has demonstrated that it can bring results.

Toward a complete solution of land use problems, however, it is equally apparent that no more than a beginning has been made. It becomes essential now to consolidate the gains already made, capitalize on experience, and continue vigorously with the help of research, surveys, and education.

There is need for continued and more widespread action to assist people in adjusting the physical patterns of their land use to the physical limitations of the land. To a considerable extent this may be accomplished through encouragement of soil conservation districts and assistance in their work. Demonstration projects of the Soil Conservation Service and C. C. C. camps working under technical supervision of the Service are today more influential than ever before in spreading the modern techniques of conservation.

There is need for continued action to assist in correcting or mitigating the economic and social forces which tend to impel or encourage physical abuse of the land.

There is need for continued and more comprehensive research, particularly in the social and economic aspects of soil conservation and other phases of land use adjustment. Information of this kind would be invaluable, not only in making a more complete appraisal of the work already accomplished, but as a basis on which future activities may proceed more rapidly and surely to the desired objectives.

There is need for a survey and mapping of the land resources of the country to ascertain accurately, and as soon as possible, their capabilities and limitations in use. Only this information will provide a physically safe and sound basis for the orderly expansion, contraction, or rearrangement of the Nation's producing acres.

There is need for progressive education to establish basic principles of conservation and land use firmly in the public mind. If present accomplishments are to be permanently effective, people must begin to think, as a matter of course, in terms of good land use. This is true not only of rural, but of urban people. The close relationship of agriculture and land use to industry and urban life is not yet widely recognized. It is altogether possible and desirable that a better understanding of this relationship be established.

ADMINISTRATIVE CHANGES

With the scope of its activities considerably enlarged by the Department reorganization, and with requests for assistance from soil conservation districts steadily increasing, personnel resources of the Service were taxed to keep abreast of developments and fulfill outstanding obligations.

To effect economies in operation and more efficient administration of the broadened program, a number of changes in the administrative organization of the Service became necessary. The region composed of Nebraska and most of Kansas and Oklahoma was abolished. Nebraska was included in the Northern Great Plains Region with Montana, Wyoming, North Dakota, and South Dakota. Kansas was included in the Southern Great Plains Region with northwestern Texas, eastern New Mexico, and Colorado, and three counties of western Oklahoma. Except for these three counties, Oklahoma was included in the Western Gulf Region with Arkansas, Louisiana and all but the Plains area of Texas.

Regional offices of the Service and those established under the submarginal land utilization program were consolidated, involving changes in location in some instances. The Service regional office at Williamsport, Pa., and the land utilization regional office at New Haven, Conn., were consolidated at Upper Darby, Pa. The Service regional office at Des Moines, Iowa, was consolidated with the land utilization regional office at Milwaukee, Wis. The land utilization reigonal office at Little Rock, Ark., was consolidated with the Service regional office at Fort Worth, Tex. The Service regional office at Salina, Kans., was abolished, and the regional office at Rapid City, S. Dak., was consolidated with the land utilization regional office at Lincoln, Nebr. The Service regional office at Santa Paula was consolidated with the land utilization regional office at Berkeley, Calif.

Area offices were established in many States throughout the country to permit more efficient administration and to distribute the services of personnel over wider territory. From area offices, personnel now serves a number of demonstration projects, camps, districts, water facilities projects, and submarginal-land projects.

In the Washington office, plans for revision of the organization structure, including redistribution of functions, were virtually completed.

OPERATIONS

Field operations of the Service were expanded considerably by cooperation with districts and other bureaus and agencies in the use and management of agricultural land. Roadside erosion-control demonstrations in cooperation with the Bureau of Public Roads, for example, have covered approximately 500 miles of critical highways.

Thirty-eight C. C. C. drainage camps were scheduled to be transferred to the Service on July 1, 1939. In view of this move, many of the camps were visited prior to that date in order to determine the organization procedures and policies to be followed when they became a part of this Service.

The Service, in cooperation with the Bureau of Agricultural Economics, the Farm Security Administration, and the Land Use Coordinator's office, participated in the Department's water facilities program, which was authorized by the Pope-Jones Water Facilities Act. Fifty-two water facilities areas, covering more than 31,500,000 acres in 17 States, had been approved for operations to promote better use of water resources and more judicious use of the agricultural and range lands.

Four new demonstration projects were established and active field operations were concluded on 68 projects. These latter projects were placed on a sustaining or maintenance basis, and technical staffs were reduced. At the close of the year, 120 projects were in this category; active operations continuing on 50 projects. Technicians remaining on maintenance projects devote their time to follow-up work on cooperating farms, and to the evaluation (through detailed examination and field tests) of erosion-control measures being used.

Cooperative working arrangements with 114 soil conservation districts were completed, in large measure necessitating reorganization of field staffs to meet the increased demand for technical services. In States in which soil conservation legislation has been enacted, soil conservation areas have been established, subdividing the State, with the subsequent creation of area staffs to supervise and guide the activities of the smaller work units. In a number of instances, C. C. C. camps and their assigned technicians have been located in strategic points within districts to alleviate the increasing demands on the technical staff.

Special attention is being given to all abandoned camp areas in which the soil conservation program has been consummated. Soil conservation associations formed before or during the active life of the camp are being encouraged to stimulate interest in a continuation of the program by farmers on whose farms soil conservation work has been done. County agents have been especially helpful in follow-up work of this kind.

Technical cooperation with the Extension Service has been continued by assigning technicians to assist in the planning and supervising of erosion-control practices on selected farms beyond the boundaries of project, camp, and district areas.

Progress reports covering evaluation studies and field tests showed that there has been distinct improvement in control measures and practices. These findings, with proper interpretation and application, have been and will be used to advantage in the formulation of district plans. Much remains to be done in determining the limitations and practical application of the findings on demonstration projects to new problem areas. Early studies dealt primarily with the physical effectiveness of the practices; they are now being extended to include some of the more important economic aspects of the program.

Cooperative work was carried on at seven locations in Puerto Rico, where bench terraces, plant barriers, contour tillage, gully control, cover-crop planting, contour furrows, water spreaders, diversion terraces, and other measures aided in the conservation of soil and moisture and permitted the cultivation of steep slopes. Workers have been confronted by unique problems, particularly the very steep slopes upon which work must be done, the lack of information as to desirable plant species and their combination in suitable rotations, as well as problems of an economic nature. Food crops and subsistence farms are largely on the steep slopes, presenting a most difficult situation. Decided advancement has been made in introducing and testing grasses which are suitable to conservation needs. The program on the island is controlling erosion, helping provide the people with essential food, and stimulating conservation thought among various agricultural interests.

Preliminary examinations were made of erosion conditions in Alaska, especially in the Matanuska project, and results of this examination will determine further activities in that territory.

Work preparatory to the establishment of a soil conservation project in Hawaii was virtually completed. It included a detailed conservation survey of the topography and type and extent of erosion on cultivated, pasture, and forest land, as well as the land utilization on the islands.

Expansion of the program placed new responsibilities on the field-inspection service and required a greater degree of coordination and a broader approach than heretofore. Inspection trips, both by groups and individuals, were carefully scheduled in order that inspection work would be appropriately distributed on the basis of activities and the urgency of problems. Their aim was to see that the Service was doing the best possible job of soil conservation, over the greatest possible acreage, at the lowest possible cost.

FARM PLANNING

Both the rate of farm planning and the quality of farm plans were improved. The volume of this work in demonstration areas decreased as many of these projects were placed on a maintenance basis, but this reduction was more than offset by increased farm planning in connection with soil conservation districts, water facilities, farm unit reorganization in the southern Great Plains in cooperation with the Farm Security Administration, and demonstration farms sponsored by the Extension Service.

The largest increase in farm-planning work occurred in soil conservation districts. Many of the conservationists formerly employed in demonstration areas have been assigned to work in cooperation with such districts.

Farm planning in connection with the water facilities program was a new development. Complete soil and water conservation plans are being developed for all farms participating in this program.

Increased attention was given to the farm unit reorganization work being conducted in the southern Great Plains in cooperation with the Farm Security Administration. Complete farm plans are formulated for these reorganized units. In some cases, units too small for economic operation were enlarged through the leasing of additional land. Also, there was progress in shifting from cash-crops to a combination of cash crops and livestock, and in the development of units providing more satisfactory income as well as for the conservation of soil and water.

In cooperation with the Extension Service, complete soil conservation plans were developed for many farms in counties not directly served by projects and camps, in order to encourage the spread of conservation practices.

Efforts have been made to refine and improve farm plans previously formulated, to evaluate the practices which have been applied, and to assist farmers in the application of measures specified in the plans.

Considerable study has also been given to farm-planning procedures used by the Service and improvements in the planning tech-

niques have been made and are now being applied. As a result, time spent in this work has been more effectively utilized.

The economic soundness of soil conservation programs for various areas and plans for individual farms was improved by: (1) The collection, analysis, and use of economic information of value in the formulation of programs for work areas; (2) the use of economic information in connection with physical information in formulating plans for individual farms; and (3) the economic evaluation of erosion-control plans and practices as applied on individual farms. In this work, valuable assistance was obtained from the various colleges of agriculture, the Bureau of Agricultural Economics, and other organizations.

CROPLAND MANAGEMENT

The Service has stressed the importance, in erosion control, of adequate crop rotations which include perennial grasses and perennial or reseeding annual legumes. Plowing, cultivating, and other tillage practices have been the principal factors in reducing the virgin organic-matter content of the soil, and accelerating erosion. On the other hand, unplowed prairie soils are rich in organic matter as a result of the accumulation of perennial grass roots, and suffer practically no erosion under proper grazing. It is apparent, therefore, that soil should be worked as little as is consistent with the economic production of necessary crops requiring tillage, and that the land should be growing perennial grasses as much of the time as possible.

In most humid sections, it is necessary to apply mineral fertilizers in order to maintain or increase crop yields and keep the plowed acreage as small as possible. Reasonably high yields per acre tend to reduce the cost of production per unit and make it possible for the farmer to take advantage of the relatively cheap production of feed from grassland. These aspects of conservation are discussed in some detail in a forthcoming bulletin, Crop Rotations for Erodible Soils.

For the lighter cultivated soils of the northern Great Plains, the use of long-time grass rotations is being strongly emphasized. In the Kidder County soil conservation district in North Dakota, where approximately 50 cooperative agreements were written during the year, a long-time grass rotation was planned for each farm. As planned, all of the cultivated lands will be periodically retired to perennial grass for a number of years. In many parts of this section the inadequate size of operating units, difficulty in establishing grass stands because of drought, and the inability of farmers to make necessary adjustments in their present system of farming, are major problems retarding the adoption of the practice.

In the Pacific Northwest, progress has been made in developing crop rotations for various problem areas, in accordance with the recommendations of the State experiment stations to meet specific land use capabilities as determined by soil type, slope, and degree of erosion. In the South Palouse River project, for example, sweetclover and grass which have been plowed under and followed by wheat, have resulted in an average increase of 12 bushels per acre over untreated land. Sweetclover and grass in the rotation provide pasture, hay or seed production, soil improvement, and a relatively

high degree of erosion control by affording cover at critical periods in the rotation sequence.

Because of the need for perennial grasses to be used in crop rotations, trial plantings of Rhodes grass, little bluestem, switchgrass, and Indian grass have been made on each project and a few camps throughout Louisiana, Arkansas, and east Texas to determine their economic values. In addition, big bluestem, blue grama, side-oats grama, hairy grama, buffalo grass, western wheatgrass, rescue grass, Italian ryegrass, Bermuda grass, and Dallis grass have been sown extensively in these States and in Oklahoma.

Experience in the revegetation of abandoned cropland and denuded range lands in the Great Plains and other semiarid sections of the West, has demonstrated that most farmers and ranchmen who have such land should be in a position to supply their own seed. When failures necessitate reseedings, such a supply will help hold down the farmers' cash outlay for seed. In certain areas, farmers have furthered revegetation through the simple expedient of distributing hay, with its seed, over the land to be revegetated. This procedure avoids the necessity for purchasing combines and threshers to harvest seed. Another advantage of this method is the mulch which the hay provides for the seed.

In the project area at Huron, S. Dak., last year, 58 farmers seeded perennial grass seed plots, varying in size from 6 to 30 acres, principally with crested wheatgrass. In the New England soil conservation district in North Dakota, the district supervisors leased 400 acres for grass-seed production plots to be planted to crested wheatgrass, slender wheatgrass, and smooth bromegrass with a deep furrowed drill.

In the southern Great Plains area, 6,095 acres have been seeded to native perennial grasses. To handle several species of light, fluffy grass seeds, which ordinary grass seeders and grain drills will not handle, cotton box-type drills were fabricated and successfully used to seed 4,403 acres in the spring of 1939. The growing of preparatory crops to stabilize soil and provide a protective residue or mulch for seedling grass plants has been strongly emphasized.

In the West, gains were made in the direction of less cultivation, and greater use of surface litter or mulch for erosion control. The utilization of residue is proving successful in the control of both wind and water erosion, and contrasts sharply with previous practices of burning stubble and turning residue under with moldboard plows.

Farmers in many parts of the northern Great Plains are making notable progress in the utilization of their crop residues. An intensive educational program, including individual farm visits and tillage demonstrations, has aided in the spread of this practice.

In the Pacific Northwest, proper adjustments and correct speed in the operation of implements have been found important in maintaining the proper amount of crop residue on the surface. Fall disking, with subsequent spring tillage, has brought good results in the growing of peas in alternate years with wheat. Previously, it was thought necessary to burn the wheat stubble in order to prepare a satisfactory seedbed, and the result was serious erosion. As winter wheat seeded on pea ground in this section does not make sufficient

growth to provide needed soil protection during the critical erosion period of the following winter and spring, other measures became necessary. To date, fall chiseling to a depth of 12 inches and the substitution of spring wheat have proved effective. If the fall chiseling of pea land is done every 5 or 6 years, the intervening fall workings of this land may be done with a moldboard plow.

Strip cropping continues as a major erosion-control practice. Efforts have been made to refine this practice, and more information on efficient methods of laying out strips has been collected. In light of past experience, point rows are becoming less of a problem, but the problem of insect control is serious in certain sections of the country. Results have clearly shown the value of strip cropping, and the necessity for accuracy in field lay-outs. Also, farmers and Service technicians alike are developing a greater appreciation for contour strip cropping, as opposed to mere field strip cropping. The practice continues to play a prominent part in supporting and protecting terrace systems and diversion systems.

In the Southeast, steady progress has been made in the use of perennial vegetation for hay production, and for the control of erosion on the more vulnerable areas of cultivated land. Approximately 25,000 acres of kudzu were planted with seedling plants produced in Service nurseries. In addition, cooperating farmers purchased and planted thousands of plants.

The use of winter legumes has also advanced in the Southeast. The acreage devoted to the growing of crimson clover for seed last year may be estimated conservatively as more than double that of any previous year. Trial plantings of bur-clover in the brown loam section of Mississippi resulted in a remarkably satisfactory growth of this legume. A considerable quantity of seed is being harvested from these plantings, and a considerable increase in the acreage planted to bur-clover is expected in the fall of 1939.

The use of crotalaria has been expanded and is being grown with corn for seed production. A large part of the seed will be left on the land to provide natural reseeding, following the last cultivation of row crops during the next 2 or 3 years. Encouraging results have been obtained in several places, particularly at Gainesville, Ga., where unscarified crotalaria seed has been sown on small grain early in the spring. There is a possibility that this legume may be used as a cover crop, following small grain, on some of the soils that are too sandy for satisfactory growth of annual lespedeza.

PASTURE MANAGEMENT

Proper pasture management has been stressed as an important phase of soil conservation work in all humid sections of the United States, and cultural practices involved in producing pasture forage, such as tillage, seeding, fertilizing, and mowing, have been considered equally important with the time and intensity of grazing.

In the Northeastern and North Central States, many farmers have had difficulty in obtaining lime, and this has considerably hampered their program of pasture improvement. However, Agricultural Adjustment Administration benefit payments to farmers for liming have been an aid to installation of the Service program in many cases, and in addition, lime has been made available to farmers

through soil conservation associations using C. C. C. and Service facilities. A number of pulverizers have been in operation during the past year on farms of cooperators, and a number of stacks and continuous kilns have been constructed.

In many sections, improvement has been made in the management of livestock after fundamental lime, fertilizer, and seed requirements of the pasture have been met. The practice of mowing pastures is new to many farmers, and it has been difficult to develop appreciation for this practice. Nevertheless, some progress has been made in this direction, and the importance of mowing pastures where the terrain is favorable is winning recognition.

Many areas of steep land formerly used for pasture have been planted to trees, not only increasing the degree of erosion control but also eliminating hazardous grazing from such areas.

The practice of ensiling grasses and legumes as a means of preserving these feeds spread during the year. It has been studied by research stations, and considerable information obtained on features of this method of feed storage. Farmers equipped to handle green materials are making increased use of the practice and it has been stressed as a soil conservation practice insofar as it eliminates the production of corn on erodible slopes.

There is a need for better types of farm equipment in most cases, particularly hay loaders, mowers, and rakes.

In the Southeast, a more desirable type of contour furrow is being built than in former years. It is wide and shallow, and built at intervals of about 6 feet.

Pastures are being more adequately limed and fertilized. This is particularly true of land being seeded to pasture. Farmers and technicians are coming to realize that seeding and sodding over old pastures is not worth while unless sufficient soil amendments are added to insure a satisfactory growth of plants.

ORCHARD AND VINEYARD MANAGEMENT

Erosion-control problems in orchards and vineyards require special treatments, and in this field additional work has been undertaken. The use of cover crops for erosion control in relation to the production and growth of trees received particular attention. There is need for more information along this line, especially in regard to the competition between cover crops and trees during the filling period of peaches as it effects the size of the fruit. This is of particular importance on soils of rather shallow depth, and where moisture is a limiting factor.

New contour plantings have been made with proper supporting agronomic and engineering practices. A definite trend toward sod cover has developed in apple orchards of the Northeast and North Central States. Demonstrations have shown that mulching material spread under the trees will not only produce superior yields and quality of fruit, but also help control erosion in old orchards where contour planting is not possible.

Similar developments are taking place on the west coast. Near Sebastopol, Calif., for example, cover crops in nonirrigated orchards were practically unheard of a few years ago. Today cover cropping

is becoming a general practice and is already protecting a considerable acreage from erosion.

Furrow irrigation of square-planted orchards on slopes above 3 percent has been a problem in California for some time. Within recent months a number of demonstrations of wide, shallow irrigation furrows have been installed which seem to provide an answer to both the erosion and irrigation problems. These furrows permit the seeding of cover crops directly in the furrows, a practice impossible with the old-type, deep, narrow furrows.

A number of improvements in farm machinery have been necessary in order to put conservation measures into effect in a more practical manner. End-gate seeders, for example, have been mounted on portable two-wheel orchard trailers to simplify seeding operations in orchards of low-branching trees on sloping land. For special use in irrigated vineyards, a furrowing unit has been devised which constructs wide, shallow, V-shaped furrows. This type furrow facilitates the handling of water and reduces erosion to a minimum.

Advances have also been made in the dry-land vineyard section of southern California where wind erosion has been a very serious problem. Controls for this condition have been worked out in cooperation with farmers and such measures as dune leveling by wind action, soil stabilization, strip cover cropping (including summer cover crops) have proved successful.

RANGE MANAGEMENT

Efforts of the Service, along with other agencies, to gain support of stockmen in range-conservation programs have met with encouraging results. Western stockmen individually are taking a more active interest in the range-conservation program, and are giving more consideration to adjusting numbers of livestock to the grazing capacity of the range. This is reflected in the increased acreage of range land covered by cooperative agreement with the Service, and by the number of large ranches entering the program.

Improvements in farm- and ranch-planning procedure have brought better cooperation. These ranch plans give particular attention to proper stocking, a definite system of grazing, development of water, use of salt, fencing, grazing during the proper season, and presentation of the complete grazing plan in a graphic form to guide the operator.

Results of the range-conservation program in reducing soil and water losses and improving range lands for grazing have, almost without exception, been greater than the expectations.

The Service began a cooperative study of range-survey methods with the Forest Service. In this field, improvements have been made in technical procedures, particularly in judging utilization of the forage, the influence of the forage-volume factor in grazing-capacity estimates, and in the increased efficiency and accuracy of range-survey compilation methods.

WOODLAND MANAGEMENT

Better management of existing woodlands; the utilization of steep, erodible lands for forest; and the planting of trees and shrubs to cover and protect eroded lands continue as an important part of the

Service program. Available data indicate that not less than 50 million acres of land now in farms should be planted to trees to protect the land from ruin by erosion, and at the same time provide a crop which can be marketed.

On several million farms, in spite of all past clearing efforts, the area of woodland still remains 25 to 60 percent of the total farm area. Much of this land now in woods should not be cleared, and farmers can make a better income from the land by managing it for a wood crop than if the land were devoted to some other crop. Woodland-management work of the Service, therefore, has attempted to help farmers handle their forest so as to get maximum erosion control and successive crops of timber, marketable annually or periodically, to form a regular part of the farm income.

By the end of the year, farm plans in camp areas and demonstration projects called for an increase of approximately 300,000 acres in woodland. The plans also called for a reduction in the area of forest range and woodland pasture.

Plantings by farmers cooperating with the Service have reached a size which now attracts public attention, and as a result, many additional farmers are becoming interested in reforestation work on their lands. In some States this increased interest has enlarged demands on State and private nurseries for planting stock.

The Service itself furnishes only part of the trees needed for reforestation of eroded lands on many of the farms where it is working. Three thousand trees may be furnished free. If additional trees are needed, the Service matches, to a fixed limit, the number of trees provided by the farmer. This directly promotes the sale of trees from State and private nurseries. In addition, the Service program stimulates interest in woodlands, and therefore creates a demand for more planting stock than was previously required.

Better forest-fire control has apparently followed the reforestation and woodland-management work. Localities in which trees have been planted and woodland-management plans prepared, report greater interest in fire protection and a reduction in the number of fires as compared with the records of other years prior to the initiation of Service work.

Reorganization of the Department increased responsibility of the Service in the field of farm forestry by transferring to it certain responsibilities in connection with the program authorized by the Cooperative Farm Forestry Act. Along with the Soil Conservation Service, the Forest Service, the Extension Service, and the Bureau of Agricultural Economics will participate in this program. The first appropriation for work under this act was made by Congress just before the end of the fiscal year, and as a consequence little could be done before June 30.

WILDLIFE

Another year's experience has provided additional evidence of the feasibility of restoring wildlife habitats as part of a sound erosion-control program. Soil and moisture conservation practices have been constructively modified to benefit wildlife, while wildlife-management practices have been devised which contribute to full and wise use of the land.

Important soil conservation practices which benefit wildlife include protection of vegetated areas from fire and grazing, retirement of land to permanent hay and woodland, pasture and range management, development of shrub borders for windbreaks and woodland, construction of terraces and terrace outlets which remain in permanent vegetation, planting of field buffer strips, and strip cropping.

Wildlife developments have continued to include the planting of gullies and galled spots, with considerable improvement in technique, including better selection of plant species and reduction in cost of treatment. Unproductive scattered spots have been protected and planted, even in rather intensively cultivated areas where properly dispersed cover is particularly essential to the maintenance of beneficial wildlife populations.

Protection and planting of pond environs and the establishment of aquatic vegetation has been developed to the point that silting of inlets and washing of fills by wave action on year-old ponds has been materially reduced. Expansion of stream-bank-protection work has improved habitat conditions for fish and other aquatic life. Beaver have been liberated in several western regions to pursue their efficient and inexpensive practice of building dams which help to conserve soil and water at a fraction of the cost involved in doing the same job by human engineering methods.

Increased emphasis was placed on the use of herbaceous vegetation to supplement the extensive use of woody plants. Outstanding in this respect is the use of perennial lespedeza and other legumes on eroding field borders, a practice already becoming well established in the Southeast. Strips of perennial legumes of value to wildlife are also being planted on the contour to serve as permanent field markers for contour operations. Observational plantings and field tests of herbaceous material are being conducted in many regions to establish the value of this type of vegetation for soil and wildlife conservation.

Another practice to which farmers of the Eastern States have responded favorably is the use of hedgerows. The hedges recommended differ from the usual fence-row vegetation in that they are carefully placed to reduce soil loss, mark contour field boundaries, and provide suitable habitats for wildlife. They are likewise planned to include only those plant species which will confine the height and width of the hedge within reasonable limits, and require the minimum of maintenance over a long period.

Some progress has been made in counting animal populations in Service work areas, and figures are slowly accumulating which may eventually serve to evaluate the efforts of erosion-control practices on wildlife. Counts of bird populations are now being made on new areas before conservation practices are installed, in order that they may be balanced against counts made later after soil conservation measures have been established. For example, records now at hand show that the numbers of nesting waterfowl on ponds established by the Service in the West increased decidedly during the year. On a group of cooperating farms in Ohio, the breeding bird population was shown to have increased 30 percent over that present when the Service began its activities there.

Observational plantings and field tests of herbaceous and woody land plants, as well as aquatic species, are under way in several

regions. The results will determine the feasibility of establishing many practices now only theoretically advisable, thus saving both time and funds. Many of these studies are being conducted in cooperation with State and university groups, which are showing an increasing interest in the biological activities of the Service.

Letters of understanding and work plans for coordinated wildlife and erosion-control activities have been drawn with numerous individuals and groups, both private and State, while formal memoranda of understanding were placed in effect between the Service and six State departments of conservation. As in the past, the closest cooperation has been maintained with the Bureau of Biological Survey.

ENGINEERING

In the field of engineering, the use of vegetation as a construction material assumed a position of new importance, particularly in the protection of natural waterways, the waterways prepared for terrace outlets, and the spillways of farm ponds and other structures. Improved methods of applying sod were developed and proved especially beneficial in localities where sod is scarce. The mulch system of sodding with Bermuda grass enabled large-scale application of this type of cover at a very moderate cost. Under earlier systems the cost of solid sodding the same areas would have been prohibitive.

In the control of gullies, emphasis has been placed on the most effective utilization of vegetation, including steps for the natural revegetation of many areas and the sodding and seeding of critical areas. An exception to this policy has been made in part of the arid and semiarid regions. A special type of treatment has been developed for use in controlling the large barrancas and arroyos where land values are high or where it is necessary to protect reservoirs and irrigation systems from excessive silting. Silt-detention dams are located where the grade of the gully or valley floor is quite flat and the valley broad enough to permit a spreading of the silt-laden run-off water.

Technicians continued work on the development of effective methods of constructing terraces with plows, harrows, V-drags and other farm equipment, especially in the Southern States. Adequate maintenance of terraces and other mechanical structures has been stressed and numerous terrace maintenance demonstrations were held in communities where terracing is a prevalent control measure.

By the compilation and dissemination of technical information on terraces and terrace construction, the Service made a distinct contribution toward a national terrace classification. Bulletins on The Prevention and Control of Gullies and on Terrace Outlets and Farm Drainageways were in the process of publication.

ROADSIDE EROSION CONTROL

Twenty-eight new roadside-erosion-control demonstration projects were established, bringing the total to 124 projects covering over 200 miles of roadway. Memoranda of understanding have been signed with 150 counties, parishes, and townships for cooperative work on critical areas of highway slopes and ditches. Work of this type has now been completed on approximately 500 miles of roadway, protecting the road ditches, embankments, and the adjoining agricultural land.

NURSERIES

Closely coordinated with woodland, wildlife, and agronomic activities, Service nurseries are endeavoring to produce the best possible planting materials as inexpensively as possible and in quantities sufficient to meet the needs of the conservation program. Toward these ends, nursery activities were consolidated. The number of production units was reduced and greater concentration of work in more permanently established nurseries was effected. Thirty-four nurseries in twenty-eight States are now in active operation, the approximate number and distribution required to meet present needs of the Service. However, in order to provide for proper soil-improvement and rotation practices, it may be necessary to increase the size of some of the nurseries.

Because the planting program of the Service calls for a wide variety of planting materials, practically all nurseries produced grasses and legumes for seed and rootstocks, as well as nursery stock proper. In addition, observational and seed source plantings of the better selections of both woody and herbaceous plants were made on major nurseries. Nursery units follow correct land use practices, and are in a position to evaluate the adaptability and usefulness of promising species and work out better methods of propagating and handling plant materials.

Nurseries furnished approximately 138 million woody plants for conservation use. Of this number, almost 127 million were produced by Service nurseries; the remaining 11 million were secured through cooperative arrangements with Federal and State agencies and from private nurseries. More than 56 million plants were grown and carried over in the nurseries for future use. Approximately 124 million plants were distributed to demonstration projects, C. C. C. work areas, and submarginal-land projects, and more than 14 million plants to cooperating Federal and State agencies for soil and moisture conservation purposes.

Nursery work involved the propagation, growing, and distribution of conifer, hardwood, shrub, and vine stock representing more than 400 different species. As in former years, the tree stocks produced in greatest quantities were shortleaf, loblolly, slash, red and white pines, black locust, ash, tulip poplar, Russian-olive, hackberry, cottonwood, willow, and juniper. The shrubs grown in largest numbers, primarily for wildlife purposes, included privet, wild plum, barberry, dogwood, viburnum, and Siberian pea. The principal vine was kudzu, with a production of 15 million seedlings.

More than 598,000 pounds of tree and shrub seeds and approximately 520,000 pounds of grass and legume seeds were collected. Also, more than 4,500 pounds of woody plant seed and 447,500 pounds of grass and other field crop seed were purchased from commercial sources. In addition to collections for stock production on the nurseries, large quantities of seed of woody plants, such as walnut, hickory, and oak, were collected for spot planting. Practically all grass seed was collected for direct planting on demonstration project and camp areas. Most of this was obtained from native stands throughout the western half of the United States, and a substantial portion was harvested by farmers. Native grasses collected in greatest quantities were blue grama, little bluestem, dropseed, switchgrass,

and buffalo grass. Some of the species most difficult and expensive to collect from native stands, as well as improved, unavailable strains, were produced in the nurseries.

Table 5 summarizes by regions the nursery stock and seed furnished by the nurseries.

TABLE 5.—*Plant materials produced, collected, or purchased and distributed, 1939*

Region	Nursery stock		Seed collected or purchased and distributed		Region	Nursery stock		Seed collected or purchased and distributed	
	Plants distributed	Plants carried over	Trees and shrubs	Grasses and legumes		Plants distributed	Plants carried over	Trees and shrubs	Grasses and legumes
	Number	*Number*	*Pounds*	*Pounds*		*Number*	*Number*	*Pounds*	*Pounds*
1	19, 311, 496	9, 890, 000	308, 395	51, 233	7	3, 036, 783	8, 061, 731	21, 409	152, 944
2	56, 323, 900	2, 660, 184	9, 578	234, 777	8	1, 733, 663	273, 240	42, 813	169, 564
3	24, 705, 578	10, 930, 116	80, 130	18, 269	9	1, 320, 274	1, 502, 070	2, 900	23, 681
4	10, 993, 720	3, 015, 808	47, 903	104, 232	10	743, 711	128, 497	5, 525	745
5	12, 021, 113	15, 930, 688	72, 434	24, 535					
6	7, 658, 145	3, 834, 602	11, 514	187, 640	Total	137, 848, 383	56, 226, 936	602, 601	967, 620

Cooperative undertakings have been developed with various branches of the Bureau of Plant Industry, including the Division of Plant Exploration and Introduction, in the introduction of plants useful in erosion control; the Division of Forage Crops and Diseases, in grass improvement-utility work; the Division of Dry Land Agriculture, in the growing and handling of plant materials; and the Division of Forest Pathology, in the control and study of nursery seedling diseases. Close working relations have also been maintained with many of the State agricultural experiment stations and other State institutions.

Many additional species and strains of plants of promising value in conservation work were assembled and planted in the nurseries for initial observation. A number of those which had been under observation for some time were selected as being worthy of increase and more extended trial under actual field conditions, while others of proven merit passed into the quantity-production category and were grown for general use. Approximately 40,000 pounds of seed of those grasses and legumes having particularly outstanding values for conservation purposes were produced in the nurseries.

Confirmatory trial plantings on problem areas under actual field conditions were extended in most of the regions in collaboration with State experiment stations. Composed of the best selections from the nurseries, these plantings served not only as a means of determining the adaptation and usefulness of the plants for particular conservation purposes but as excellent demonstrations.

Nurseries furnished planting material of 64 species for hillculture studies, and arrangements were made for propagating and handling plant materials of promise for hillculture purposes as a part of the regular nursery observational program.

CIVILIAN CONSERVATION CORPS OPERATIONS

An average of 357 C. C. C. camps were operated under the technical supervision of the Service during the year. Table 6 gives the quota of camps, personnel, and enrollees by quarters.

TABLE 6.—*Camps, personnel, and enrollees supervised by the Soil Conservation Service, fiscal year 1939*

Date	Camps operated [1]	Supervisory personnel	Enrollees [1]
	Number	*Number*	*Number*
July 1, 1938	361	4,041	65,674
Oct. 1, 1938	361	4,028	66,315
Jan. 1, 1939	356	4,001	67,567
Apr. 1, 1939	354	4,017	63,669
June 30, 1939	354	3,983	65,674

[1] Average number: camps, 357; enrollees, 65,780; enrollees per camp, 184.

Enrollees, under supervision of the technical staffs, executed such labor as was required by cooperative agreements between the Service and individual farmers and ranchers. In addition, 64 agreements making C. C. C. labor available to soil conservation districts were completed.

As in the past, enrollees planted trees and shrubs on badly eroded areas. They built check dams, seeded and sodded the banks of gullies, and revegetated galled spots. But more of the work of the enrollee has now been directed toward putting in contour furrows, water spreaders, terraces and terrace outlets, digging outlet channels, seeding and sodding waterways, running grade and strip-cropping lines, and rerunning fences on the contour. In addition, enrollees helped in the construction of farm ponds, the improvement of woodlands, in wildlife planting, stream-bank protection, and other aspects of the soil conservation program.

Operations were completed on more than 1,250,000 acres by the C. C. C. in the past year, a material increase over previous years.

Considerable improvement was made in that phase of enrollee education for which the Service is responsible—soil conservation and job training. All enrollees were given an opportunity to benefit by practical job instruction, both on the work project and during their leisure hours; at no time were less than 50,000 availing themselves of this privilege. Approximately 2,600 members of the Service staffs in C. C. C. camps devoted some 200,000 hours to instruction of enrollees in the field; 2,900 of the supervisory personnel devoted 120,000 hours of their time to instruction in related work during leisure time.

The accident frequency during the year was again reduced, and 119 camps were reported as operating without experiencing a single lost-time accident.

Emergency work was again an important factor in practically all of the camp programs, with enrollees regularly assisting in fire fighting, flood rescue work, and the search for missing persons. In Colorado and adjoining States, the camps were called on to cooperate with other agencies in grasshopper eradication work during the summer months of 1938 and again in the late spring and early summer of 1939.

Available enrollee labor has been better utilized than ever before, materially increasing the man-day accomplishments. This was partly due to better planning of the work programs; but to a certain extent it was the result of cooperation with other using services,

such as the Forest Service, National Park Service, Division of Grazing, and Bureau of Agricultural Engineering.

WATER FACILITIES

Considerable progress was made in advancing the use of small water facilities in semiarid regions of the West. While this progress was only partly reflected in the report of actual field operations, State agencies, agricultural leaders, farmers, and ranchers became better acquainted with the purposes of the water facilities program authorized by the Water Facilities Act. The value of such facilities as stock ponds, irrigation systems, and wells in promoting better land use was more generally recognized.

At the close of the year, 81 areas were authorized for planning in 17 States, and 52 areas were authorized for concurrent planning and operations. In addition, regional conservators of the Service and regional directors of the Farm Security Administration, in cooperation with State authorities, were authorized to select 10 counties within each State, outside of areas already authorized for planning or operations, in which a maximum of 4 individual or 2 group facilities might be installed. In this way, 131 counties were designated, and in many of them demonstrations were under way.

COOPERATION ON PUBLIC LANDS

Under the Soil Conservation Act of 1935, the Department was directed to make surveys and to carry out measures designed to provide permanently for the prevention and control of soil erosion on public as well as private lands. Serious erosion conditions, largely brought about by unwise use, have long existed on many areas under Federal control. During the past year, in cooperation with the agencies having jurisdiction over these lands, material progress has been made toward the solution of these problems.

SURVEYS AND PLANS

Range, conservation, and other physical surveys have been made on a considerable number of areas as the basis for practicable plans and programs for erosion control, and for the proper use and management of these lands. On certain areas, particularly Indian reservations, investigation of the land-tenure problems, the dependence of the reservation population on the reservation resources, and other economic problems have been found necessary to effective execution of plans for erosion control and proper land management.

In many cases, the surveys and plans have been followed by cooperative action programs under which operations are undertaken jointly by the Soil Conservation Service and other Federal agencies. In numerous instances, however, the principal aid rendered by the Service has been the preparation of technical plans for adjustments in land use for immediate application by the land-administering agencies, such as the Office of Indian Affairs of the Department of the Interior, prior to the initiation of extensive erosion-control operations on a cooperative basis.

Thus, as a result of range surveys conducted on the Uintah-Ouray Reservation in Utah, the Office of Indian Affairs undertook to adjust

stocking to estimated grazing capacities almost immediately after the preliminary estimates had been made. On the Gila River Reservation in Arizona, the important steps needed to secure improvements in land tenure were instituted shortly after the initial studies had progressed to the point where obvious improvements could be determined, and measures were initiated to secure the complete elimination of livestock from the badly eroded Gila River range.

On the Papago and San Xavier Reservations of southern Arizona, water supply, flood, irrigation, and erosion-control projects have been instituted by the Office of Indian Affairs as the result of surveys and recommendations prepared by the Soil Conservation Service. On the Hualpai Reservation in northern Arizona, the Office has proceeded with recommended stock-water developments aimed at eliminating overgrazing. On the basis of an engineering survey of the erosion and flood problem on the Truckee River (Pyramid Lake Reservation, Nev.), Congress has appropriated $75,000 for the preparation of detailed structural plans and initiation of structural works. All of these operations have been undertaken by the Office, largely as the result of the initial surveys and plans made by the Soil Conservation Service.

Office of Indian Affairs consideration of factual data bearing on the extent and condition of resources had led to the reorientation of the Indian C. C. C. and other land-development programs on the reservations, toward a more effective and more comprehensive program centered upon the protection and development of basic resources. General instructions have been issued by the Office to coordinate its C. C. C. programs with recommendations of the Soil Conservation Service.

Similar surveys have been carried on and plans developed in cooperation with the Forest Service, and with the Division of Grazing of the Department of the Interior.

OPERATIONS

On a number of critical areas where surveys have shown the necessity of extensive erosion-control operations, the Soil Conservation Service, at the request of several of the Federal land administering agencies, has given assistance in initiating and carrying out the plans developed. Generally the labor, equipment, and necessary materials are supplied by the agency charged with the administration of the lands concerned.

On the Navajo and Hopi Reservations the cooperative conservation work prescribed under the general memorandum of understanding between this Service and the Office of Indian Affairs has continued. Erosion-control treatment and improved range and farming practices, fencing to control livestock, water-spreading structures, water developments on range lands, plantings, and other soil conservation work have been carried on in all parts of the 15-million-acre reservation. Vigorous and successful efforts have been made during the year by the Office, working in conjunction with the Indians, to remove excess livestock, particularly nonproductive horses, and approximately 12,000 have been removed to date. Soil Conservation Service personnel have provided technical advice and assistance on most phases of the land use program.

Plans for erosion-control operations have been initiated in a similar manner on other public lands in cooperation with the Forest Service of the Department and the Division of Grazing and Bureau of Reclamation of the Department of the Interior. Where a private operator is using these public lands under a lease or permit, with the approval of the administering agency, that operator is made a party to an agreement with the Soil Conservation Service. This agreement provides a plan for the structural and other measures necessary for the control of erosion, as well as a plan for the use or management of the area that will insure the necessary future protection of the forage and soil resources.

The extent of Soil Conservation Service cooperation can be seen in table 7.

TABLE 7.—*Soil Conservation Service cooperation on public lands*

Project	Areas	Acres	Project	Areas	Acres
Watershed:			Other operations:		
Navajo	1	24,479,040	In cooperation with—		
Gila	1	11,520,000	Forest Service	10	170,000
Rio Grande	1	18,767,760	Division of Grazing	13	7,077,805
Wind River (Shoshone)	1	2,268,073	Office of Indian Affairs	14	5,641,101
			Bureau of Reclamation	1	15,000
Total	4	56,944,873	Total	38	12,903,906
			Grand total	42	69,848,779

RESEARCH

Research work expanded and moved closer to conclusive findings in a number of fields. Six new experiment stations began conservation investigations at Beemerville-Marlboro, N. J.; Athens, Ga.; Amarillo, Tex.; Dixon Springs, Ill.; Marcellus, N. Y.; and McCredie, Mo. Research work in soil and water losses under various types of land use was completed at Statesville, N. C., and the station discontinued. Erosion-control investigations in connection with the production of bright tobacco were started in the vicinity of Raleigh, N. C.

Construction and hydrologic phases of work in irrigation and drainage, formerly in the Bureau of Agricultural Engineering, were transferred to the Service by the Secretary. In the field of irrigation, research was started to develop new methods of irrigation which may supplant those now causing rapid depletion of soil by erosion in steep areas.

Much of the work on the spacing and grading of terraces was completed at the old stations, permitting new work on pressing problems in other places. Important new studies of revegetation in the southern Great Plains were started; and in the Pacific Northwest, investigations into wind erosion control by trashy fallow began. In addition, work was inaugurated on badly eroded bean lands of southern California.

Several research projects were modified to consider the relationship of micro-organisms in connection with the most economic and practical use of organic matter. A study of erosion control in orchards of the Southeast was inaugurated near Clemson, S. C. In the hydrologic field, much of the information collected in recent years on water run-off has proved valuable in the development of plans for possible flood-

control operations on the land. Basic construction work at the hydrologic stations at Coshocton, Ohio, and Waco, Tex., was completed.

EXPERIMENT STATIONS

Developments at the newer experiment stations continued. The establishment of plots and other experimental areas, together with the installation of necessary technical equipment for several complete studies, was pushed to completion. Where satisfactory answers were secured at older stations to the problems being studied, the research into those problems was terminated or revised. At a few of the stations, new studies were initiated to answer pressing questions arising in the field. The rate at which new work can be undertaken has been determined by the speed with which older studies can be completed, thus releasing funds for the new studies.

CROP ROTATIONS

This year's results again showed the value of crop rotations in saving soil. At Tyler, Tex., soil loss from rotation plots in sorghum, cowpeas, and cotton, with a winter crop of hairy vetch, averaged 15 tons per acre; while from the plot planted to cotton each year, and lacking the benefit of a winter cover crop, the loss was 23 tons per acre. The winter cover accounted for much of the saving, yet the beneficial effects of sorghum and cowpeas were evident.

The station at Bethany, Mo., reported that although rainfall was deficient, soil and water losses from rotation, as compared with nonrotation plots, showed the superiority of rotations. Annual loss of soil from a 1-year rotation plot of oats followed immediately by Korean lespedeza has been 3 tons per acre over a 3-year period. The average annual loss from a 3-year rotation of corn, oats, and clover with timothy has likewise been 3 tons per acre. The loss from a plot in corn during each of the 3 years was four and a half times as great, or nearly 14 tons per acre.

STRIP CROPPING

Results from experiments with strip cropping, though varying for different agricultural areas, bore out previous findings. Loss of soil from strip-crop areas was considerably less than from areas lacking a strip of close-growing vegetation, but differences in run-off were less pronounced.

At Zanesville, Ohio, the first 3-year rotation cycle was completed on duplicate strip-cropping plots. The plots, designated A and B, were about one-half acre in size and were on a 15-percent slope. Crops used were corn, wheat, and grass, the latter a mixture of a legume and timothy. Each crop has occupied each of the three different strips into which the plots have been divided. Water and soil losses for the 3 years are given in table 8. A rough comparison may be made with data obtained from a 2½-acre area on a slope of approximately 14 percent, planted to the same crops, but in rotation. Losses from this watershed averaged nearly 10 inches of water annually, and about 30 tons of soil per acre, that is, water loss was almost one and one-half times that from the strip-crop plots, and soil loss was almost three times as great.

TABLE 8.—*Water and soil losses from duplicate strip-crop plots, Zanesville, Ohio, 1936–38*

Year	Annual precipitation	Water loss			Water loss as percentage of annual precipitation			Soil loss per acre		
		Plot A	Plot B	Average	Plot A	Plot B	Average	Plot A	Plot B	Average
	Inches	*Inches*	*Inches*	*Inches*	*Percent*	*Percent*	*Percent*	*Tons*	*Tons*	*Tons*
1936	40.35	6.8	10.4	8.6	16.8	25.7	21.3	13.6	18.6	16.1
1937	43.74	8.1	8.6	8.4	18.5	19.6	19.2	8.0	8.5	8.2
1938	40.57	4.9	5.3	5.1	12.0	13.0	12.5	7.5	9.2	8.4
Average	41.55	6.6	8.1	7.3	15.8	19.4	17.5	9.0	12.1	10.5

Careful observations and field measurements led to conclusions that increase in soil losses, and to a smaller extent increase in water losses, resulted from widening the cultivated strip and from allowing this strip to deviate from the contour.

In order to obtain experimental data, the station at Temple, Tex., established 12 new areas from which soil and water losses under strip cropping will be compared with the losses occurring under single cropping. Two slopes were chosen, of adequate length to allow 6 strips per plot and of sufficient width to make the areas comparable to field conditions with respect to deviation from contour, irregularity of slope, presence of rills, and other variables. Data secured from these areas will be supplemented by careful observations and records on cooperating farms within the nearby Elm Creek demonstration project. Thus information will be obtained as to width and number of strips that can be safely used, and also as to which crops offer greatest protection against erosion at different periods of the year.

TERRACES

Data collected at a number of stations indicate a definite relationship between length of terrace interval and soil loss. These data substantiated earlier findings that as length of the slope was increased, loss of soil became somewhat greater.

This relationship was not apparent, however, when the terrace intervals were planted to close-growing crops, such as small grains or green-manure crops. From the installations at Statesville, N. C., little or no relationship could be detected between soil loss and the length of terrace interval, indicating again that various combinations of factors such as soil type, degree of slope, type of precipitation, crop, and the like, must be investigated in the development of conservation techniques.

Loss of water has tended to decrease when terrace intervals were lengthened. However, other factors such as degree of slope, soil type, plant cover, interval between rains, and intensity of rains are variables to be balanced against this finding.

On the whole, terrace-channel grades up to 3 to 4 inches per 100 feet of length proved to be satisfactory. Standing water in level experimental terrace channels, with either open or closed ends, drowned crop plants or interfered with cultivation, except in localities where rainfall was deficient or where unusually porous soil occurred.

CONTOUR TILLAGE

Tillage operations carried out on the contour, especially on terraced slopes, helped materially in reducing soil movement and water loss. At Ithaca, N. Y., where rainfall during 1938 was low, contour tillage operations on nonterraced potato fields increased the yield more than 30 bushels per acre, which was a 17-percent increase over the yield of fields not cultivated on the contour. At Hammondsport, N. Y., grape yields were similarly increased from 2,148 to 3,448 pounds per acre, an increase of 61 percent. Contour cultivation obviously has been effective in conserving water, especially under conditions of deficient rainfall.

Contour tillage has also retarded soil movement, as disclosed by controlled plot studies and field inspections. The practice, however, cannot be regarded as effective under all conditions when used alone. At Tyler, Tex., for instance, contour cultivation of a field on a 7.5-percent average slope, planted to a rotation using cotton, corn, and cowpeas with a winter cover of oats, permitted gullies to increase in size. However, on a similar field, where terracing was used in conjunction with the measures just enumerated, gullying did not occur, and soil loss was only about one-fourth as much as that from the field not terraced.

ORGANIC-MATTER ADDITIONS

Soil analysis at Clemson, S. C., showed that a single application of organic matter, of as much as 4 tons per acre, disappeared rapidly and did not apparently alter physical properties of the soil.

At midwestern stations, applying barnyard manure at the rate of 16 tons per acre, turning under green-manure crops, and applying straw at various rates, reduced soil and water losses. This effect seemed to result in part from improved physical conditions of the soil, and in part from improved plant growth affording increased surface protection.

In a study at Lincoln, Nebr., certain plots were supplied with organic matter worked into the soil, others had organic matter applied to the surface, and still others were merely tilled. Of the 17.9 inches of rain which fell between April 23 and September 8, 1938, percentages retained in the several plots were as follows: Straw on surface, 54.3; straw disked in, 38.7; straw plowed in, 34.2; no straw, basin-listed, 27.4; no straw, plowed, 20.7; no straw, disked, 19.5; decayed straw plowed in, 17.4 percent.

Similarly, when wheat straw as a surface mulch was applied at the rate of 2 tons per acre, absorption was sufficiently rapid to prevent run-off from the application of water with a sprinkling apparatus for 10 hours at a rate of 1.5 inches per hour. When water was applied at this same rate to a plot of the same soil which had been basin listed, and also to a plot into which straw had been incorporated, run-off occurred before the end of the first hour.

STUDIES OF SOIL ERODIBILITY

Several project laboratories continued investigations to determine the extent to which physical and chemical properties of soils can be used as indices of erodibility. In studies made at Clemson, S. C., phys-

ical properties, as indicated by the mechanical composition, percolation rate, suspension percentage, and dispersion ratio, appeared to give a good index of the relative erodibility of soils. Soils having a high suspension percentage and a high dispersion ratio take up water rather slowly, consequently yield considerable run-off. Moreover, the run-off contains a greater amount of eroded material than does run-off from soils which take up water more rapidly. Investigators working with desert soils in Arizona reached similar conclusions and determined, in addition, that a high content of calcium was associated with high erodibility. This relationship was found to be true also for certain soils in the Southeast. It was found also that highly erodible desert soils had a high sodium content or a low content of iron or potassium.

Results of analyses made of soils from plots at Bethany, Mo., indicated that approximately 2½ tons of organic matter per acre per year were lost from a fallow, cultivated plot, and that approximately 1½ tons per acre per year were removed by erosion from a plot repeatedly planted to corn. At Clarinda, Iowa, losses averaged for three plots continuously in corn, were approximately 1¼ tons, while at both stations, variations in organic-matter content on plots in a good rotation or in sod, were so small as to be within the range of experimental error.

As water is applied on an area, either as rain or by rainfall simulators, the rate at which it filters into the soil has been observed to decline. Recent investigations indicated that this decline was associated largely with the formation of a thin, compacted layer at the soil surface. The beating of rain and the flow of water over the surface, it was believed, sorted the soil particles at the surface and rearranged them, fitting them more closely together, thus reducing the size of spaces through which water might enter. Soils with a high dispersion ratio and a high suspension percentage seemed to develop this compact layer more quickly than soils having more stable aggregates. Covering the soil surface with plant residues, as shown by application of straw mentioned above, maintained the infiltration rate at a much higher level than when such residues were not provided. Examination showed that under such residues the compacted layer did not form.

MOISTURE EQUIPMENT

The number of soil tensiometer installations in connection with soil-moisture investigations increased. The tensiometer, a porous cell placed at any desired depth in the soil and attached to a vacuum gage by means of suitable tubing, makes possible the measuring of capillary tension in the soil. By means of computations and conversions the moisture content of the soil may then be determined. The tensiometer method offers the advantage of continuous readings at a given location without disturbance of the site being investigated, since the porous cell remains in place throughout the period of investigation. At many of the experimental sites standardization of the instruments is still in progress, consequently conclusions regarding their suitability under the various conditions encountered are still tentative.

Under semiarid and arid conditions, soil-moisture content is often so low that it cannot be studied by means of a tensiometer. Con-

sequently, other methods of quickly determining moisture content were investigated. One of them, involving the use of a high-frequency electrical circuit, based on differences in dielectric capacity of soil and water, is promising. The search for materials to be used in constructing a durable and reliable condenser has been successful, and tests will be continued.

To speed the collection of information on run-off and erosion, as influenced by soil, slope, cultural practices, and vegetation, considerable effort has been directed to the testing and use of apparatus for applying water under controlled conditions. Nearly all the apparatuses in use consist of a series of sprinkler nozzles mounted on suitable supports and connected with a constant, controllable water supply. The run-off from plots being studied was collected through rate-measuring devices in such a way that samples for laboratory analyses might be secured. The equipment could be moved from plot to plot, thus making possible a large number of determinations in a relatively short time.

CLIMATIC STUDIES

The Muskingum Climatic Research Center, established as a State W. P. A. project in June 1937, to make a complete climatic survey of the Muskingum Valley in Ohio, continued in operation throughout the year. During most of this period 500 self-recording rain gages were in continuous operation. Records from approximately 150 additional stations, operated by various agencies in the upper Ohio and Susquehanna watersheds, were collected. On the basis of these data, three series of monthly publications were initiated: (1) Precipitation in the Muskingum River Basin (daily maps and tabulations), (2) Precipitation on the Muskingum River watershed (maps for 30-minute periods), and (3) Hourly Precipitation on the Upper Ohio and Susquehanna Drainage Basins. These maps have proved indispensable in the study of rainstorm morphology, and in rainfall run-off studies.

A second State W. P. A. project was set up in Ohio to make statistical and cartographic analyses of existing climatic data. In order to delimit erosion regions on the basis of climate, maps, showing the distribution of climate (according to Thornthwaite's classification) were prepared for each year and crop season from 1900 to 1938. By demonstrating the frequency of occurrence of different climatic types, in various parts of the country, these maps aided in the rapid determination of climatic hazards in relation to erosion and agriculture in general.

In the subhumid and semiarid regions, wind erosion is essentially related to drought. To obtain a measure of drought frequency, the daily rainfall records for all Weather Bureau stations were analyzed. A technical bulletin on this subject, Rainfall Characteristics as Related to Soil Erosion, was ready for publication at the close of the year. Since drought is in part a function of high temperature, the Weather Bureau temperature records were examined to determine the frequency of consecutive days exceeding given critical high temperatures.

Hydrologists and agronomists engaged in flood and crop-yield forecasting, respectively, are concerned with complementary portions

of the precipitation—the first, with the portion which runs off and the second, with that which does not run off but is available in the soil for the use of the plants. An attempt has been made to derive a single climatic index of precipitation effectiveness which would serve in both run-off and crop-yield studies. This study has been carried out in the upper Licking watershed, a tributary of the Muskingum. From the rainfall data supplied by 50 gages and from the stream-gage records, a continuous record of field-moisture deficiency, as it varied areally and chronologically, has been computed for the period from June 1937 to the present. Maps showing the daily distribution of field-moisture deficiency have been prepared.

In order that the study of field-moisture deficiency might contribute to our knowledge of the influence of land use practices on run-off from entire watersheds, a continuous survey of farming operations and the condition of the land throughout the upper Licking watershed was started in March 1938. The condition of the watershed with respect to land use at the precise time of each rain was known, and its effect on run-off could thus be determined.

The one climatic element which has never been adequately measured is evaporation from the soil. A method for measuring the actual emission of water from a land surface (combining evaporation and transpiration) was developed and reported in an article entitled "The Determination of Evaporation from Land and Water Surfaces," which appeared in the January 1939 issue of the Monthly Weather Review. The method depended on measurement of the gradient of moisture concentration and the intensity of turbulent mixing of the air within 20 feet of the ground.

The first evaporation station was installed in October 1938 over a meadow on the Arlington Experiment Farm in Virginia. Twelve additional stations were installed in Maryland, Ohio, and California. Since it has been found that the instruments measure condensation and direct absorption into the plants, as well as evaporation and transpiration, they should supply data to explain how agriculture was possible in some regions where the annual rainfall did not exceed 10 inches. A satisfactory method of measuring losses of soil moisture through evaporation and transpiration will be directly applicable to run-off studies and should be helpful in crop forecasts.

PHYSIOGRAPHIC STUDIES

Continuation of the studies reported in Technical Bulletin No. 633, Principles of Gully Erosion in the Piedmont of South Carolina, have been directed toward localization of the processes of gully formation with respect to rock type, soil slope assemblage, and drainage pattern. Observations to date have shown that, in general, each small unit drainage basin consisted of convex slopes where soils were generally thin, and of concave slopes where soils were normally thick; that these soil-slope assemblages were associated with certain natural land forms; and that the hazards of erosion were definitely related to these factors.

Preliminary conclusions seemed to demonstrate the desirability of making soil conservation plans for complete unit drainage areas rather than for individual farms. An improved method of classifying slopes may develop from this work.

The study of mass movement of soil (earth flow, soil creep, and slumping) was continued in southeastern Ohio and neighboring parts of West Virginia and Pennsylvania.

Study of the peculiarities of erosion in a region of subterranean drainage resulted in publication of a circular entitled "Soil Erosion in the Karst Lands of Kentucky."

EROSION HISTORY

Current erosion in the United States should be recognized to be the same continuing processes that began almost immediately after settlement in all sections of the country, which everywhere attracted the attention of a comparatively small number of progressive farmers. The value of their experience in interpreting present conditions, in determining the fundamental causes and the rates of erosion, and in supplementing controlled experimentation, has been demonstrated by published studies of the history of erosion in Virginia and Oklahoma, the oldest and youngest agricultural areas in the country. This led to the establishment, in 1938, of W. P. A. erosion history research projects in 10 States. The systematic survey of early literature on erosion has been continued through 1939.

Data assembled on the Virginia, North Carolina, and South Carolina projects have been analyzed and incorporated into a comprehensive survey of the history of erosion in the southern Piedmont, one of the major agricultural problem areas of the country. A similar study of the erosion history of New England, utilizing material assembled on the Massachusetts project, is nearing completion. The agricultural and economic implications as well as the considerable extent of past erosion in that region, and their relation to present-day problems, has been clearly demonstrated.

From records of floods in the past, secured largely from the Ohio, Indiana, Pennsylvania, and Massachusetts projects, a study was made of floods on minor watersheds in northeastern United States, including their relation to progressive changes in land use, and their effect on floods of the larger drainage basins.

HYDROLOGIC STUDIES

Studies in land use hydrology were conducted on experimental watersheds near Coshocton, Ohio, Waco, Tex., Hastings, Nebr., Mexican Springs, N. Mex., and on smaller watersheds near 10 experiment stations.

On the north-Appalachian experimental watershed near Coshocton, Ohio, 15 small watersheds ranging in size from 1 to 5 acres, and 4 intermediate watersheds, from 30 to 300 acres, are being studied. Most of these areas were not planted until the spring of 1939, and no comparisons are yet available. Run-off at various points on Little Mill Creek and most of its tributaries is being measured at 13 stations. In addition, 5 gaging stations were constructed on Mill Creek in cooperation with the Muskingum Watershed Conservancy District for the measurement of run-off from areas ranging in size from 5 to 50 square miles. This system of gaging stations and complementary rainfall stations constitutes the most complete existing experiment on the concentration and segregation of flood flows, and affords a means of investigating those principles of flood run-off

that are fundamental to the development of a program of land treatment for flood control. The system also provides data by which the relation between size of area and flood run-off can be analyzed.

At the Black Land experimental watershed near Waco, Tex., construction work was virtually completed. Five stations were established for the measurement of run-off on Brushy Creek, the main stream of the 5,800-acre watershed, and in addition, measurements were made on 12 smaller areas of 300 acres or less, on 12 single-practice natural watersheds, and on 4 plots of one-quarter acre. Erosion was measured at all of the smaller stations and at several of the larger ones. Few intense storms occurred during the year, and these were not of sufficient severity to produce more than nominal run-off—0.8 inch per hour being the maximum rate of run-off recorded on any of the watersheds. Consequently, sufficient data were not obtained to indicate definite trends in land use influences. The records, however, are being utilized in the flood control surveys of the Department.

Early in the year, headquarters of the central Great Plains experimental watershed was moved from Lincoln to Hastings, Nebr. During the fall and winter, comparisons of straight-row cultivation, contour cultivation, and strip cropping were started on 17 natural watersheds between 3 and 5 acres in area. Three gaging stations were installed on Beaver Creek and eight ¾-acre pasture areas are being placed under measurement.

An investigation was made of the effect of crop residues on the amount of water absorbed by small plots subjected to artificial rainfall. The results of this study were reported in Research Bulletin 112 of the Nebraska Agricultural Experiment Station. A notable finding was that straw residue is as effective as pasture in increasing the amount of water absorbed, the infiltration capacity of bare soils being increased three to five times by application of a light mulch of straw.

On the Navajo experimental watershed near Mexican Springs, N. Mex., records of run-off and erosion were maintained for 14 watersheds ranging in size from 196 to 46,080 acres. On these watersheds, investigations of the effect of grazing practices on run-off and erosion are being made. Since run-off occurs infrequently in the Southwest, records for several more years will be required before definite conclusions on grazing influences can be made.

Hydrologic studies in cooperation with the United States Geological Survey and State agricultural experiment stations were continued by the Service at Shenandoah, Iowa, Coon Valley, Wis., High Point, N. C., and Pullman, Wash. Installations were improved and certain changes in procedures made to improve the recording of run-off and silt loss and to present data in more usable form.

Run-off studies to secure information needed in the planning of water facilities, soil conservation, and flood-control work were continued. These studies, originally limited to demonstration projects of the Service, were extended to Service experiment stations and to a number of State agricultural experiment stations.

The installation of rainfall-recording stations and of run-off measuring stations was completed on 80 small watersheds on 22 projects in 16 States. Temperature and humidity recording stations were

installed on a number of the projects. Work was done on topographic, soil, and cover surveys and on the preparation of maps for each of the watersheds. Rating tables based on hydraulic laboratory tests were prepared for all of the completed run-off measuring stations. Standard procedures to be used in the collection and recording of the data in the field were developed. Forms for tabulation of rainfall, run-off, and other related information were prepared. Details of the work were described in Run-off From Small Drainage Basins, an article appearing in the October issue of Agricultural Engineering; and in a series of mimeographed technical memoranda.

The location of the run-off stations, the number of watersheds at each location, and the status of the work on June 30, 1939, are shown in table 9.

TABLE 9.—*Status of run-off studies, June 30, 1939*

Location of project	State Conservation Service region	Watersheds	Completed stations		Record started	Surveys and maps					
						Soils		Topography		Cover	
			Rainfall	Run-off		Completed	In progress	Completed	In progress	Completed	In progress
		No.	*Meters*	*Inches*		*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
Bath, N. Y.	1	4	12	4	March 1938	1	3	1	3	1	3
Freehold, N. J.	1	4	7	4	February 1938	1	3	1	3	1	3
Hagerstown, Md.	1	5	7	5	March 1938	0	5	0	5	0	5
Americus, Ga.	2	4	6	4	July 1938	0	4	1	3	0	4
Danville, Va.	2	3	3	3	do	3		3		0	3
Hamilton, Ohio	3	4	5	4	June 1938	0	4	4		0	4
Garland, Tex.	4	6	7	6	August 1938	0	6	3	3	0	6
Bentonville, Ark.	4	6	6	6	November 1938	2	4	6		0	6
Muskogee, Okla.	4	4	6	4	do	0	4	4		0	4
Edwardsville, Ill.	5	4	7	4	March 1938	4		4		4	
Fennimore, Wis.	5	4	9	4	June 1938	4		4		4	
Vega, Tex.	6	3	6	3	March 1938	3		3		3	
Colorado Springs, Colo.	6	4	6	4	May 1938	4		4		4	
Albuquerque, N. Mex.	8	3				1	2	1	2	0	3
Santa Fe, N. Mex.	8	3				0	3	0	3	0	3
Safford, Ariz.	8	6	18	5	August 1938	0	6	0	6	0	6
Emmett, Idaho	9	2	5	2	do	0	2	0	2	0	2
Newberg, Oreg.	9	4	4	4	July 1938	2	2	2	2	2	2
Santa Paula, Calif.	10	5	12	5	do	0	5	0	5	0	5
Watsonville, Calif.	10	4	5	4	September 1938	1	3	1	3	1	3
Moscow, Idaho, State Agricultural Experiment Station.		2	2	2	1937	2		2		2	
Blacksburg, Va., State Agricultural Experiment Station.		3	3	3	May 1939	0	3	0	3	0	3
Athens, Ga., Soil Conservation Service Experiment Station.		[1] 1									
Miles City, Mont., Bureau of Animal Industry.		[1] 2									
College Park, Md., State Agricultural Experiment Station [2]											
La Fayette, Ind., State Agricultural Experimental Station.[2]											
Total		90	136	80		28	59	44	43	22	65

[1] Watersheds selected and designs prepared.
[2] Plans made for establishment of several run-off studies.

Studies in conservation hydraulics and instrumentation were conducted at the Spartanburg (S. C.) outdoor hydraulic laboratory, the hydraulic laboratory of the National Bureau of Standards, and the hydraulic laboratory of Cornell University, Ithaca, N. Y.

At the Spartanburg laboratory, a comprehensive study was made of conservation channels lined with Bermuda grass. It was found that a good stand of this grass can withstand the erosive action of floodwaters flowing at velocities up to 8 and even 10 feet per second. In addition to Bermuda grass, a number of other types of vegetation, including kudzu, common lespedeza, *Lespedeza sericea*, and Dallis grass, were tested to determine their value for channel protection. Experiments were also made to determine the capacities of types of notches much used in conservation structures. All of the information yielded by this work was put to immediate practical use by field technicians of the Service.

Most of the studies being carried out by the Service at the hydraulic laboratory of the National Bureau of Standards are directed toward improvement of the instrumentation and methodology of conservation research. Along with these studies, however, research on the mechanics of the water-erosion process is going forward. Rate-measuring devices, divisors, water-stage records, artificial-rainfall apparatus, and methods and instruments for sampling mixtures of soil and water were developed and improved. Outstanding developments were completion of studies of the type H flume, a new rate-measuring device designed to permit precise measurements of both low and high rates of run-off (this flume has been installed on 15 research projects of the Service); and development of the type F artificial-rainfall apparatus.

At the hydraulic laboratory of Cornell University, the Service completed development of a new type of weir for use in the measurement of natural run-off from small watersheds. Tests were made to establish the calibration of this device under a wide range of conditions, and from these data were derived rating curves for almost 100 weirs already installed in various parts of the United States. This procedure removed the necessity of calibrating installations individually by means of the current meter, and thus saved time and money.

SEDIMENTATION STUDIES

Extensive development of both field and laboratory investigations in sedimentation was required to meet the needs of the flood-control surveys of the Department for quantitative data on present and prospective damage to flood-control reservoirs, stream channels, floodways, and valley flood plains by sediment resulting from accelerated soil erosion. Particular attention was given to developing techniques for classifying physical damages and for determining sources of damaging sediment. Considerable time was devoted to planning field investigations requested by flood-control committees and to training additional personnel employed in the flood-control surveys in techniques of sedimentation studies.

A selected, annotated bibliography on sedimentation, as related to soil conservation and flood control, containing 101 titles, was prepared for use in the Department and among cooperators. The Service also sponsored a W. P. A. project in New York City for literature research in sedimentation. Work was about 30 percent complete at the year's end. Ultimate publication of a comprehensive bibliography is planned.

Investigations of sedimentation in southern California resulting from the flood of March 1938 were continued in the field until October 1938, and renewed in June 1939. A reconnaissance of the New England flood and hurricane area was made during a 2-week period following the storm of September 21, 1938. Effects of stream-channel erosion and sedimentation were noted and measured.

RESERVOIR SILTING INVESTIGATIONS

A revision of the U. S. Department of Agriculture Technical Bulletin No. 524, Silting of Reservoirs, was completed to provide additional information on many reservoirs described in the first edition, and summaries of data on all reservoirs surveyed to July 1, 1938. A report entitled, "The Effect of Accelerated Erosion on Silting in Morena Reservoir, San Diego County, Calif." (U. S. Dept. Agr. Tech. Bul. No. 639), based on field work in 1935–36, was prepared in cooperation with the Forest Service.

Additional reservoir-sedimentation surveys were made as part of the flood-control surveys under the direction of the Department's Flood Control Coordinating Committee on the following reservoirs: Lake Dallas, near Denton, Tex.; Texas & Pacific Railroad Reservoir, Weatherford, Tex.; Lake Nasworthy, San Angelo, Tex.; White Manganese County Reservoir, Cartersville, Ga.; and Palingtown Reservoir, Spring Grove, Pa. In addition a repeat survey was made of the Kenwood Reservoir, on Cherry Creek, near Denver, Colo., where observations after the spring run-off in 1939 showed that a considerable volume of sediment had accumulated during the year since the first survey, which was completed July 1, 1938. A complete reconnaissance of all reservoirs in the Trinity watershed, Tex., was also completed.

Surveys of sedimentation ranges on the Senecaville, Piedmont, Tappan, and Pleasant Hill reservoirs of the Muskingum Watershed Conservancy District were completed. These surveys established an accurate basis for future sedimentation measurements on these important flood-control and water-conservation reservoirs.

STREAM AND VALLEY SILTING INVESTIGATIONS

A manuscript, Some Principles of Stream and Valley Sedimentation, as Exemplified in Lafayette County, Mississippi (U. S. Dept. Agr. Tech. Bul. No. 695) was completed. Although based primarily on detailed studies in a limited section of northern Mississippi, this manuscript presented the results of studies in other parts of the country, and provides a comprehensive statement on culturally accelerated stream and valley sedimentation. Among the major principles found to be widely applicable were the tendency of erosional debris to accumulate as sediment relatively close to the place of origin, and the comparatively greater importance of sand than silt as a cause of damage by sedimentation. The appendix included data on mechanical analyses of about 350 samples of stream and valley sediments, probably the largest published list of such analytical data.

Investigations of sedimentation in the Merrimack Valley, N. H., and middle Rio Grande Valley, N. Mex., were continued and studies of various phases of stream and valley sedimentation were begun in several parts of the Driftless Area of southwestern Wisconsin, southeastern Minnesota, northeastern Iowa, and northwestern Illinois.

In Coon Creek Valley, Wis., test borings were made on 87 valley cross sections, and the surface profiles were measured as a basis for future comparative surveys. The flood-plain deposits accumulated during the period of culturally accelerated erosion were found to be as much as 13 feet in thickness in places, the greatest depths being about one-third of the way up the main valley.

An investigation was made of silting in the York River, Va., between West Point and Gloucester Point, by comparing water depths on Coast and Geodetic Survey charts of 1857 and 1911 with depths taken by soundings in the fall of 1938. Results indicated a fivefold increase in the average annual rate of sedimentation from 104 acre-feet per year in the period 1857–1911 to 566 acre-feet per year in the period 1911–38.

Brief inspections were made of valley sedimentation in parts of the drainage basins of Codorus Creek, Pa.; Galena River, Wis. and Ill.; Black River and Trempealeau River, Wis.; Washita River, Okla.; Trinity River, Tex.; Yazoo River, Miss.; and Coosa River, Ga.

Sediment-load investigations were continued at the Enoree River station near Greenville, S. C.; but work in this field near Statesville, N. C., and Dadeville, Ala., was suspended for lack of funds.

The hydraulic laboratory established in cooperation with the California Institute of Technology at Pasadena continued to carry on fundamental research on the mechanics of sediment transportation.

HILLCULTURE

Comprehensive field experiments to test the value of promising erosion-control plants, and vegetational methods for safer and improved economic use of hilly land have been started through cooperative work with the agricultural experiment stations of Alabama, California, Iowa, Maryland, and Ohio.

Preliminary results show that contour organization and treatment of sloping land is an essential step in managing these erodible sites in a manner which will build up and conserve the soil under productive use.

The use of chemical growth-promoting substances in powder form was found to be effective and inexpensive for rooting cuttings of several species of trees, such as black locust, holly, pecan, and honeylocust.

A new product has been found in a species of *Phellodendron*, or corktree, which may offer an economic outlet for this new erosion-control plant. Preliminary tests show that the berries, which are produced in abundance, yield a compound which has highly promising insecticidal properties.

The wealth of economically desirable erosion-control plants that may be made available from our abundant native vegetation through selection and development is illustrated by work on locust. Although the tree has been widely used in plantations since the days of the early settlers, no previous systematic effort had been made in this country to select and develop superior strains. Now, more than 50 promising strains have been selected for critical study and evaluation. One of the most promising for use in the economic control of erosion is the Shipmast variety, because it is superior to the ordinary locust in tree form and durability of the wood, can

be maintained in a pure state without great difficulty, and can be reproduced by economically practical, vegetative methods.

Field studies showed that black walnut now growing on farms may be made to yield a considerable supplemental income to the farmer if the nuts are gathered and assembled, through community cooperation, in carload lots. Normally, such quantities will be readily bought by cracking establishments at fair prices. This supplemental cash return, based on $1 per 100 pounds of nuts, is equivalent to approximately $10 per acre annually for areas averaging 10 bearing walnut trees.

Similar studies on beach plum in the Northeast, cherry bark oak in Arkansas, and mesquite in Texas, show that these are particularly promising plants for hillculture use.

The assembly of hillculture data was facilitated through W.P.A. projects sponsored by the Service in Washington, D. C., and New York City. More than 2,000 completed articles on promising erosion-control plants of economic value, and on methods pertinent to hillculture practices, were assembled and made available to technical workers. In addition, complete digests on a number of plants having special hillculture significance were made and distributed.

Toward the solution of hillculture problems, the Service cooperated with a number of State agricultural experiment stations, the Bureaus of Plant Industry, Entomology and Plant Quarantine, and Chemistry and Soils, and the Forest Service.

DRAINAGE INVESTIGATIONS

There was a noticeable trend among landowners toward rehabilitating existing drainage systems that had deteriorated and become inefficient during the recent depressed agricultural period. These drainage improvements to increase farm profits and the efficiency of farming operations were generally limited to highly fertile lands already in cultivation. Tile manufacturers reported greater demands for small agricultural tile to drain wet spots in fields which were not in the most productive state.

The C. C. C. camps assigned to the Service to help rehabilitate the drainage works of organized drainage districts, operated at peak capacity, and applications from drainage officials for assistance greatly exceeded the ability of the camps to provide it.

Run-off and ground-water studies were continued in the northern Minnesota marshes in cooperation with the Minnesota Department of Conservation and the University of Minnesota, to determine the effect of drainage on ground-water storage and run-off in that area. In 1935 a number of automatic water-stage recorders were installed in ground-water wells in Aitken, Beltrami, and Roseau Counties, and have been operated each season. The data obtained have indicated that the ground-water elevation in that area bore a close relation to the amount of rainfall. Indications were that the amount of storage available in the soil for spring floods could be calculated in advance by determining the elevation of the ground-water table the preceding November. At least one more season's record is desired before definite conclusions can be formed.

The studies and experimental work in cooperation with the University of Minnesota and the Minnesota Department of Conservation to develop methods of making concrete drain tile that will resist destructive action of soil alkalies, soil acids, and frost now have covered testing of 158 brands of portland cements from 103 mills of the United States, Canada, and Europe. Since this study was started in 1920, thousands of specimens have been exposed in the university laboratory to solutions of magnesium sulfate and sodium sulfate, and in Medicine Lake, S. Dak., to the waters that contain about 14 percent of sulfate and are so corrosive that nonresistant concretes are completely disintegrated after a few months of submergence.

Losses through the use of poor-quality concrete tile practically have been eliminated where Department drainage engineers have been consulted and the drainage improvements were constructed in accordance with their recommendations.

Investigations to determine the most effective depth and spacing of drains for sugarcane land were confined to securing additional data on the effect of experimental drainage systems on water-table levels and their influence on the production of cane. During the period 1930–38, both the tile-drained areas and the areas drained with deep, open ditches averaged more tons of cane and more pounds of sugar per acre than the check plots drained with the shallow ditches ordinarily used in the area. However, it is doubtful whether the increase in yield is sufficient to meet the additional cost of installing and maintaining deep drainage. Observations and measurements will be continued during the 1939 crop-growing season, after which field investigations will be discontinued and a final report on the work prepared.

In cooperation with the Mississippi State Planning Commission and the W. P. A., field work on an investigation of all organized drainage enterprises in Mississippi, to determine existing conditions and to develop plans for coordinating and rehabilitating the enterprises, was completed in June.

The 38 C. C. C. camps engaged in drainage work were located in Delaware, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maryland, Missouri, and Ohio. They have been repairing or rehabilitating existing drainage works constructed by organized public drainage districts to improve health conditions, promote public welfare and convenience, provide better drainage for public highways and towns and villages, as well as to serve agriculture. No work has been done on privately owned ditches. The program was limited to well-settled areas of proved agricultural value, and no work was carried out that would bring new lands into cultivation or improve lands better suited for wildlife or forests than for agriculture. Active cooperation was furnished to the camps by the organized drainage districts or associations, and these organizations agreed to maintain, for a minimum period of 5 years, the work performed by the C. C. C.

Organized drainage districts contributed over $900,000, principally in labor, materials, and equipment to assist the camps in clearing 2,800 miles, redigging 1,600 miles of ditches, repairing 62 miles of public tile drains, and building nearly 900 water-control structures. This work benefited approximately 1,500,000 acres of land.

WATER CONTROL IN THE PEAT AND MUCK SOILS OF FLORIDA

For the past 6 years investigations have been carried on in cooperation with the State Agricultural Experiment Station at Belle Glade, Fla., on water control in peat and muck lands of the Everglades. The Everglades contain some 2,500,000 acres of peat soil, of which about 100,000 acres produce sugarcane and truck crops. Drainage is essential but losses due to subsidence following drainage have been so serious that optimum levels of the water table must be maintained to conserve the land. Over a period of 24 years, levels taken on 12 representative peat areas showed total losses through subsidence of 4 to 6½ feet. Results obtained to date indicate that the rate of subsidence depended primarily upon the level of the water table.

IRRIGATION INVESTIGATIONS

The irrigation water supply at the close of the year compared unfavorably with that of the last 2 years. In most Western States, there was a serious shortage of water for late-maturing crops, especially where the water supply must be taken from direct stream flow. In most areas where the supply must be obtained from ground water, there will be drastic lowering of ground-water levels, resulting not only in a depleted supply but added power cost. Although the heavy precipitation of the preceding year brought some rise in the average ground-water levels, more than average yearly precipitation and artificial recharging will be necessary to bring ground-water levels in many arid sections to safe elevations.

The broad-furrow method of irrigation, developed in recent years, was utilized for a larger acreage and tested more intensively during the year. By this method more of the fertile topsoil is made available to roots because of the decreased depth of cultivation. Erosion in the furrows is reduced because water flows over a wide, smooth bottom. Better cover crops may be grown, and better control of soluble fertilizers attained. The distribution of water is improved, and the application efficiency increased, while the labor cost of irrigation is decreased.

Growers who have tried this method have been favorably impressed, and during 1939 about 3,000 acres have been changed over from the old system of using deep, narrow furrows to the improved broad-shallow furrow system. For the most part trials have been made on 5- to 20-acre tracts covering a variety of orchard conditions throughout southern California. These commercial trials have served as a combined laboratory and proving ground, and farmers have been guided as to the best adaptations to meet specific conditions.

Simple machinery for making broad furrows has been developed and made available to farmers at low cost. The fact that a satisfactory broad-furrowing tool can be built for $25 has been largely responsible for the widespread trials.

In cooperation with the Bureau of Plant Industry, studies on the use of irrigation water were continued near Bard, Calif. In cooperation with the Bureau of Plant Industry and the Oregon Agricultural Experiment Station, similar studies were continued at Medford, Oreg., with particular attention given to the irrigation of pear orchards. It appears, after the results of several years' work have

been analyzed, that actual determination of the moisture content of the soil itself must be made if the most efficient use is to be made of the soil, water, and trees.

Actual determinations of soil moisture in the major part of the root zone (the upper 3 feet with pears on heavy clay soil) afford at least four specific and necessary indications for the conduct of orchard irrigation. (1) They indicate the quantity of soil moisture available for use by the trees. (2) By periodic sampling at intervals of a week to 10 days, the orchardist knows how rapidly soil moisture is being lost, and can anticipate very closely the time when soil moisture will be seriously depleted. (3) By taking samples after irrigation, the orchardist may learn to what depth and in what amount irrigation water has penetrated, and he has a measure of the efficiency of his irrigation methods. (4) Knowing his soil-moisture conditions and the rate at which moisture is being lost, the orchardist can more intelligently coordinate other orchard operations, such as spraying, blight control, and harvesting, with irrigation, and is in a much better position to judge whether irrigation or some other equally important orchard operation should have the right-of-way. The Medford studies are being continued by the Bureau of Plant Industry.

A report entitled "The Agricultural Situation in San Fernando Valley, Calif.," issued in limited edition, initiated a series of studies which are expected to continue for several years in cooperation with the Board of Water and Power Commissioners of the city of Los Angeles. The investigations will have to do generally with the future of agriculture in the valley, and the best methods of irrigation to be practiced in supporting it. San Fernando Valley, northernmost portion of Los Angeles, comprises about two-fifths the area of that extensive city. Service to the approximately 50,000 acres of irrigated land is almost completely effected by city-owned works. Water is sold on a quantity basis, accurately measured, and delivered with a minimum of waste. An opportunity is thus afforded to study practical phases of irrigation in a typical section of southern California under exceptional conditions of control.

PUMPING FOR IRRIGATION

Throughout the United States, parts or all of many farms could be irrigated by pumping, either from ponds, streams, or wells. Owners or operators of such farms have needed information enabling them to determine (1) whether soil and water suitable for irrigation was available; (2) the kind of irrigation plant and equipment most satisfactory for their purpose; and (3) some indication of initial and operating costs. Having examined these factors the farmer could decide whether or not irrigation pumping was likely to be profitable on his farm. To meet the widespread need for information of this kind, manuscript of a Farmers' Bulletin, Small Irrigation Pumping Plants, was completed.

Usually the greatest expense of farming under irrigation, over that of farming in humid regions, lies in the cost of building and operating the irrigation system. Eventually all or nearly all these costs are borne by the farmer himself in meeting the assessments of his organized irrigation district, mutual company, or water users' asso-

ciation. He is seldom equipped to use intricate technical data, but he is served by his engineer who is prepared to apply them to bring about economies reflected in those assessments.

Technical Bulletin No. 652, Flow of Water in Irrigation and Similar Canals, published in 1939, brought up to date the results of experimental work conducted for many years. The bulletin provides data for use by engineers in designing, measuring, and operating irrigation, power, municipal, and similar canals, and for courts and attorneys interested in cases involving the carrying capacities of open artificial canals. The text includes comments pertinent to the design and operation of open canals. These comments are the result of more than 25 years of observation on such channels.

IRRIGATION IN HUMID REGIONS

The wide interest in irrigation in humid regions noted in recent years has increased the number of requests for information on this subject. To aid the farmer a publication on supplemental irrigation was revised to present the latest development and practices. Farmers have asked for additional data on the proper handling of supplemental irrigation, when to apply water to the various crops, how much to apply, the average annual costs, and the average annual benefits to be secured from supplemental irrigation.

Incidental studies have shown that in the humid section of the country, two areas located not more than 50 miles apart may have the same total annual rainfall, but that differences in the distribution and intensity of the rainfall during the crop-growing season may make supplemental irrigation profitable in one area and unprofitable in the other. An analysis of rainfall records in relation to irrigation needs during the crop-growing seasons throughout the humid regions of the country has been started, in cooperation with the Weather Bureau and the W. P. A. This study will make possible the preparation of maps of each State in the humid regions, showing where supplemental irrigation can be expected to be profitable. At the close of the year the project was about 50-percent completed.

WESTERN WATER LAW

A study of selected features of western water law, under an informal cooperative arrangement between the Bureau of Agricultural Engineering, Bureau of Agricultural Economics, and Office of the Solicitor, was completed and a report submitted to the Solicitor for publication. The purpose of the report is to provide the basis for answering questions concerning the acquisition and exercise of water rights, which are arising under the Department's activities in connection with soil conservation, flood control, and administration of the Water Facilities Act.

SNOW SURVEYS

Water supply forecasting based on snow surveys was developed in Nevada more than 30 years ago. Up to 1935 it had been successfully applied on most of the principal watersheds in Nevada, Utah, and California and had been used to some extent in Oregon, Idaho,

Wyoming, and Washington. Since July 1, 1935, the Division of Irrigation has undertaken to extend and unify the activity throughout 11 western States. The snow surveys were extended to many areas not previously served.

Liberal cooperation from other agencies permitted an expansion of the winter-sports informational service which proved so successful the preceding year. This service involved weekly radio descriptions of road, weather, and snow and ice conditions at principal western winter-sports areas. The broadcasts were made from San Francisco, Calif.; Medford and Portland, Oreg.; Boise, Idaho; Salt Lake City, Utah; and Denver, Colo., and were made possible by the cooperation of the National Broadcasting Co., the Weather Bureau, Forest Service, National Park Service, and many clubs and other interested organizations. Copies of the broadcasts were distributed to newspapers and press associations, clubs, railroads, chambers of commerce, and others.

EVALUATION STUDIES AND FIELD TESTS

Evaluation surveys and field tests, carried on with the assistance of State agricultural experiment stations, contributed to the refinement and improvement of a number of conservation practices. Mulching of orchards, both solid and in contour strips, proved valuable in those districts where vegetation cover was not suitable. The straw mulch was especially effective in increasing the rate and amount of water infiltration into the soil, thus decreasing run-off and soil loss. Studies of strip cropping emphasized the need for maximum adherence to the contour, and for leaving broad and well-grassed waterways. Improved rotations, supplemented by lime and fertilizer as needed, contributed to the effectiveness of strip cropping. The use of permanent meadow strips for supplementing the rotated strips proved effective and practical. On long slopes, terraces were demonstrated to be a necessary supplement to strip cropping, especially on the upper part of the slopes. Narrow strips of small grain placed just above the terrace channel were effective in lessening erosion on cultivated fields and in keeping the silt out of the terrace channels.

Contour furrowing of pastures and range lands in the southern Great Plains increased water penetration, and resulted in denser vegetation and increased yields. Contour furrowing was also helpful in water spreading in the Southwest. In the same region, studies improved the location and construction of stock ponds and reservoirs. In the Southeast, observations and field trials proved that native herbaceous plants of outstanding value to wildlife could be produced abundantly by disking at certain times of the year.

ECONOMIC INVESTIGATIONS

Research in the economics of soil conservation, cooperative with the Bureau of Agricultural Economics and 17 State agricultural experiment stations, was continued in order to determine the economic and social consequences of soil and water conservation programs from the point of view of the individual farmer and of the public.

Particular attention was directed to the preparation of advance estimates showing the probable economic and social consequences of soil and water conservation farming as compared with the probable economic and social consequences of the conventional system of farming. As a basis for these estimates, it was necessary to acquire information on yields, production, labor time, power and equipment used, materials used, livestock feeds and feeding, livestock changes in kinds and numbers, cash receipts and expenditures and, finally, farm income.

The advance estimates have been considered the final product of much of the research in the economics of soil conservation. As prepared for farms operating under soil and water conservation programs and for the same farms assuming their operation under conventional systems of farming, they have offered an effective basis for comparison of the recommended systems with the farmers' previous systems. In turn, the comparisons have constituted a basis for appraisal of the economic feasibility of the recommended soil and water conservation programs. From such appraisals, suggestions can be made for their improvement.

The detail involved in the preparation of these advance estimates and the possibilities of comparison and appraisal growing out of their use is indicated in tables 10, 11, and 12, representing the study of a Wisconsin farm. The data were taken from a recent mimeographed publication from that State. The publication pointed out that gross income under the soil-conserving plan of operation has not been reduced appreciably below that of the soil-depleting plan, and concluded "* * * in general, the program recommended for soil conservation in Wisconsin will not reduce but instead will maintain immediate income." Future income should, by reason of the soil-conserving practices, be safeguarded still further.

TABLE 10.—*Acreages and production before and after adding the soil conservation program*[1]

Crop	Area		Yield per acre		Estimated production		Estimated production	
	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B
	Acres	*Acres*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Pounds*	*Pounds*
Corn	18	13	40	40	720	520	40,320	29,120
Oats	24	13	40	40	960	520	30,720	16,640
Barley	12	6	32	32	384	192	18,432	9,216
			Tons	*Tons*	*Tons*	*Tons*		
Alfalfa	8	16	2.2	2.2	17.6	35.2	35,200	70,400
Clover and timothy	22	24	1.5	1.5	33	36	66,000	72,000
Silage	8	8	7	7	56	56	112,000	112,000
Rotation pasture	8	8						
Total	100	88						
Additional permanent pasture		12						

[1] For convenience, the advance estimate for the farm in its organization without the soil conservation program is called plan A and the advance estimate for the farm with soil conservation is called plan B.

TABLE 11.—*Disposal of crops before and after adding the soil conservation program* [1]

Feed production and use	Corn		Oats		Barley		Alfalfa		Clover and timothy		Corn silage	
	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Total amount produced	40,320	29,120	30,720	16,640	18,432	9,216	35,200	70,400	66,000	72,000	112,000	112,000
Used for seed	224	168	1,920	960	1,152	576	0	0	0	0	0	0
Balance used for feed for	40,096	28,952	28,800	15,680	17,280	8,640	35,200	70,400	66,000	72,000	112,000	112,000
16 cows	10,000		5,080		0		35,200		27,000		96,000	
18 cows		0		0		0		70,400		23,580		112,000
8 other cattle	0		3,200		0		0		12,000		16,000	
9 other cattle		0		2,400		0		0		21,420		0
6 horses	0	0	9,000	9,000	0	0	0	0	27,000	27,000	0	0
120 hundredweight of hogs [2]	24,000		9,720		17,280		0		0		0	
80 hundredweight of hogs [2]		22,856		2,480		8,640		0		0		0
120 chickens [2]	6,096	6,096	1,800	1,800	0	0	0	0	0	0	0	0

[1] For convenience, the advance estimate for the farm in its organization without the soil conservation program is called plan A and the advance estimate for the farm with soil conservation is called plan B.
[2] Includes some purchased feed.

TABLE 12.—*Livestock, butterfat, poultry, and egg production and income before and after adding the soil conservation program* [1]

Product	Total production		Home use		Farm use		Sold		Income			
									Price per item		Total price received	
	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B
Butterfat—pounds	3,888	4,374	128	128	160	180	3,600	4,066	$0.35	$0.35	$1,260	$1,423
Cows—number	3	4	0	0	0	0	3	4	60.00	60.00	180	240
Veal calves—do	15	17	1	1	3	4	11	12	10.00	10.00	110	120
Hogs—hundredweight	120	80	4	4	0	0	116	76	8.00	8.00	928	608
Poultry—number	80	80	12	12	0	0	68	68	.50	.50	34	34
Eggs—dozen	1,304	1,304	300	300	0	0	1,004	1,004	.25	.25	251	251
Total											2,763	2,676

[1] For convenience, the advance estimate for the farm in its organization without the soil conservation program is called plan A and the advance estimate for the farm with soil conservation is called plan B.

While these advance estimates are still in the exploratory stage, their preparation has led to tentative conclusions, such as those given in an unpublished Nebraska report:

An advance estimate prepared for a typical 160-acre farm incorporating therein the recommended changes in farm organization and operation, has indicated a probable future income of approximately the same amount as that to be gained under the conventional method of farming, or even a slightly higher income when crop yields are kept at the present figure. Crop rotations, legumes, and better practices in farm operation should make for an increase in earning relative to the conventional method of farming as time permits the improvements to become effective. The important consideration here is that, even though the recommended system, including soil and water conservation, has not immediately increased income, apparently no great tendency for a marked decrease in income has been evident. This is considered important.

Similar advance estimates made in Minnesota, Ohio, Oregon, Pennsylvania, and Wisconsin, and other States, resulted in the conclusion

that farmers can adopt a complete soil and water conservation program on their farms and make it succeed economically as well as physically.

It also became clear that in a number of cases barriers to the immediate economic success of the soil and water conservation program existed. A report on a farm in North Carolina, for example stated:

> An advance estimate prepared for one of the farms in the series of farms representative of varying size, type, and degree of change, and particularly representative of farms having no idle land prior to the program, and for which the acreage of row crops, chiefly corn, was reduced, indicated that the program in the long run would improve the productivity of the farm with little or no sacrifice in income. However, lowered income is expected while the program is being inaugurated. Pressure of the mortgage on this farm has proved an obstacle to the inauguration of the program in the early period. This situation apparently has been reflected in the comparatively slow progress thus far made in establishing the program.

Thus, in addition to indicating the possibilities of sucess in soil and water conservation, these studies indicated that certain factors militate against the adoption of otherwise worth-while soil- and water-conserving programs, and pointed to the need for careful study of individual cases and areas in which such cases predominate. Where impending factors exist, some form of subsidy apparently will be needed to carry the operators over the major difficulties standing in the way of immediate or early adoption of satisfactory programs of farm organization and operation, including soil and water conservation.

While the advance estimate has been considered as the most effective method of demonstrating the probable economic consequences of recommended soil and water conservation programs as contrasted with the probable economic consequences of the conventional systems of farming on the same farms, and while it is recognized that severe limitations surround an unguarded comparison of the records and accounts of farms which have operated under a conserving system and those which have operated under a conventional system, such a comparison can have considerable merit if properly safeguarded. In the light of these limitations, 30 Illinois farms cooperating in the conservation program were matched with an equal number of neighboring farms, not cooperating, on the basis of acreage, soil ratings, proportions of land tillable, and land valuations. Although it is too early to expect final results, it would seem that the cooperating farms, and after a 3-year period, had improved materially over those which employed the usual system of cultivation, as shown in table 13.

TABLE 13.—*Trends in land use, cooperating and noncooperating Illinois farms*

Year	Proportion of tillable land in grain crops		Proportion of tillable land in soil-building and soil-conserving crops	
	30 cooperators	30 noncooperators	30 cooperators	30 noncooperators
	Percent	*Percent*	*Percent*	*Percent*
1935	77.8	86.5	22.2	13.5
1936	73.6	88.2	26.4	11.8
1937	71.7	91.4	28.3	8.6

Apparently, the noncooperating farms suffered a reduction in their acreage of soil-building crops largely because soil deterioration cut down their ability to grow legumes. On the other hand, the improved rotations, applications of limestone and fertilizer, and other soil conservation practices such as contour farming, strip cropping, and terracing apparently resulted in higher crop yields on the cooperating farms. This is shown in table 14.

The final test of whether the conservation system of farming has an advantage over the conventional system is in the income figures. Although the cooperating farms in the beginning had an advantage in net income, as shown in table 15, this advantage was increased during the 3-year period by almost 100 percent.

TABLE 14.—*Trend in crop yields on cooperating and noncooperating Illinois farms, 1935 and 1937*

Crop	Production per acre in 1935		Production per acre in 1937	
	30 cooperating farms	30 noncooperating farms	30 cooperating farms	30 noncooperating farms
	Bushels	*Bushels*	*Bushels*	*Bushels*
Corn	49.8	47.2	55.6	48.8
Oats	32.5	29.8	51.5	48.3
Soybeans	16.8	19.8	22.2	19.6

TABLE 15.—*Gross income, expenses, and net income on cooperating and noncooperating Illinois farms, 1935 and 1937*

Items	1935		1937	
	30 cooperating farms	30 noncooperating farms	30 cooperating farms	30 noncooperating farms
Gross receipts per acre	$14.86	$13.91	$20.44	$16.81
Total expenses per acre	8.57	9.11	10.54	10.27
Net income per acre	6.29	4.80	9.90	6.54
Net income per farm	1,254.00	882.00	1,931.00	1,250.00

On the basis of these records and accounts, it has paid to follow a planned program of soil and water conservation; for in addition to saving the soil, the better land use and erosion-control practices have been associated with higher yields, a larger gross farm income, operating expenses no higher than on farms following the old or usual system of farming, and finally, higher net farm incomes. While the planned soil conservation program has maintained and, in fact, has built up and improved these farms in earning power, the soil-depleting system of farming has resulted in declining productivity and earning power. Similar results were obtained in two other demonstration project areas in Illinois in which farm records and accounts were kept.

The preceding reports and those which follow are, in general, favorable as to the economic feasibility of the recommended soil and water conservation programs. However, not all of the advance estimates which have been computed, not all of the detailed studies

which have been made, and not all of the farm records and accounts thus far maintained are favorable. Some lack of feasibility has been discovered, some adverse situations. Advance estimates revealed that in some instances farmers found it difficult or impossible to follow the recommended soil and water conservation programs.

Often this was because the farm was too small to permit the more extensive operations involved in the recommendations. At times inadequate finances hindered cooperation. Sometimes the farmer lacked equipment. In other cases, tenants objected to the extra work which they believed was involved in soil conservation. Some farm records and accounts revealed situations in which the farm incomes were too small to afford any surplus over and above that necessary for farm operation and family living expenses to permit the changes involved in a soil and water conservation program.

Further study of both the favorable and the unfavorable situations is essential to determine whether a subsidy may be needed for some of these cases. Certainly an understanding must be developed through such studies as to the alternatives open to these farmers and their farm lands if they continue a depleting system of farming. The question necessarily must be answered: "Where will they end if they continue in the old way—in rural poverty—in rural depopulation?"

Studies in Oklahoma, in which conservation practices were related to specific elements of farm family living, showed that both white and colored farm operators cooperating with the Soil Conservation Service in programs of soil and water conservation appear to be above the average in many of their attributes. This fact indicated that if maximum public benefits are to be obtained from the soil conservation demonstrations, the Service must work out means of securing the cooperation and interest of individuals who are now less amenable to conservation effort. To this end, investigations were started to determine the forces responsible for community standards and community activity, and thus shed light on the reasons why farm operators endure erosion and what may be necessary to secure adequate conservation.

The public advantage of soil and water conservation on private lands was indicated by studies of 22 water supplies in the Piedmont of North Carolina. According to these investigations, erosion on private land has added approximately $200,000 to the annual costs of water purification. Besides, these Piedmont water-supply reservoirs have been filling rapidly with the erosional debris from upstream farm lands. It was difficult to determine the exact extent to which this erosion damage could be eliminated, but it remained as a pertinent fact that the erosion damage was existent and that some substantial part, if not all of it, could be eliminated through appropriate soil and water conservation measures applied to the farm lands.

Like studies initiated this year in Texas have already revealed sufficient information to indicate that similar losses are existent there, although their magnitude is as yet undetermined.

Damage to public investments and increases in municipal costs resulting from erosion on private lands suggest that interests other than the individual farm operator may find it to their advantage to encourage, sponsor, and in some cases actually finance a soil and water conservation program on private land.

PUERTO RICO

Research work in Puerto Rico was continued to develop and test methods that could be used to stabilize soil on the steep slopes kept under cultivation. Cooperative experiments in terrace construction were started at the Federal experiment station at Mayaguez. Bank-slope experiments were continued, as were measurements of soil and water losses from plots under various kinds of grass cover. Experiments carried out in cooperation with the insular experiment station at Rio Piedras were concerned with developing information on the relative value of some 175 species of grasses for bank stabilization and for use on terrace outlets, gully banks, road cuts, and road fills. These grasses have been planted in small plots for observation. At the same station, experimental installations were made to get additional information on methods of gully control.

LAND USE IN FOREIGN COUNTRIES

To obtain information on conservation developments abroad, a survey of ancient and modern land utilization in European and Mediterranean countries was undertaken, with special reference to soil conservation and flood-control work applicable in the United States.

In England it was found that gentle rainfall, and the fact that a relatively large proportion of the land had remained in grass, materially reduced the danger of erosion. In Scotland similar protective influences existed; and in addition, an extremely slow decomposition of vegetation litter in the northern portion of the country formed a protective cover on most of the upland soils.

In the Netherlands particular study was devoted to reclamation work on the Zuider Zee. The drainage of this area and the use of fertilizers and soil amendments were found to be the essential factors in bringing into productivity land formerly a part of the bed of the sea.

In the Les Dombes area of France, a rotation of fishponds and grainfields was studied. Here, where impervious subsoils prevail, land is devoted to a grain crop for 1 year, and then is flooded and employed as a fishpond for a period of approximately 2½ years. The production of fish under these conditions was found to be equal to the amount of either mutton or beef that could have been raised on the same area had it been in high-grade pasture.

The survey showed that reclamation of sand dunes and adjacent marshy land on the French coast followed a series of carefully planned steps. First, the dune area was stabilized with pine trees, broom plants, and other vegetation. Then the 2½ million acres of marshy, poorly drained soils were drained by means of surface ditches and intensively planted to pine trees and oaks. The entire region has now become a valuable forested district, highly productive of both timber and naval stores.

In southern France and Switzerland, control work on a number of famous mountain torrents was studied, as well as the intensive systems of terracing, part of which appeared to be of great antiquity and dated back at least to the time of the Roman Empire. In many places, terraces with supporting stone walls were carried to great heights up the mountain slopes. The stabilized land was planted to grapes, artichokes, perfume roses, oranges, and vegetables.

In Italy, additional phases of torrent control were seen, and an intensive examination was made of the work of lowland reclamation, including the draining of the Pontine Marshes. Here, successful farms have been established on land which defied improvement for 2,000 years, until modern methods of drainage were introduced.

Timgad's ruins, in the midst of eroded hills and valleys of northern Africa, proved a striking example of the destruction which can come from the deforestation of hills, the removal of vegetation cover by overgrazing, and the accumulation of erosion debris on the lowlands. Originally, this area was highly productive.

The valley of the Euphrates River was intensively examined. Only heaps of fallen walls marked the site of Babylon, and the eroded country around formerly populous cities was distinguished by filled-in, abandoned irrigation ditches in valleys covered with deposits from wind and water erosion.

Palestine was found to be a land with every evidence of injury from deforestation of the mountains, overgrazing of the hills, and gully erosion in portions of the plains. At the same time, encouraging evidences were seen of possible reclamation of much of the hill land by reforestation which could be combined with contour cultivation and modern methods of erosion control to reestablish orchards and pastures on the adjacent fields and valleys.

The extensive observations made on this survey furnished a fund of information as to the causes of the successes and failures of conservation methods used in a large number of European countries and older civilized lands. Analysis and application of these findings should prove materially beneficial in future soil conservation work in the United States.

Coincident with the survey in Europe, historical studies were made of those foreign countries from which the United States has derived either its crops or traditional methods of farming. Through library research, types of erosion control are sought which have proved successful in regions with climatic and physiographic conditions similar to those in this country.

SUBMARGINAL-LAND PURCHASE AND DEVELOPMENT

Under the recent reorganization of the Department the functions of the acquisition, development, and management of submarginal agricultural lands as provided for in title III of the Bankhead-Jones Farm Tenant Act were transferred to the Service from the Bureau of Agricultural Economics and became a component part of the Service program for conservation and improved use of agricultural lands. The land use adjustment projects being administered by the Service under this act include lands acquired under the National Industrial Recovery Act of 1933 and the Emergency Relief Act of 1935, as well as lands acquired and being acquired under the provisions of title III. Activities originally undertaken under the former two authorities are often referred to as the old program, while activities under the latter are generally referred to as the new program.

As of the close of the year commitments under both the old and the new programs had been made for the purchase of approximately 10,800,000 acres of land for a total purchase price of $47,500,000.

Approximately 9,100,000 acres of that total represent commitments under the old program. Purchase of this acreage was practically completed during the year, with the delivery of checks on 563,000 acres, purchased for $2,574,000. Of the 1,700,000 acres for which commitments have been made under the new program, nearly 1,600,000 acres were accepted for purchase in 1938–39. Checks were delivered to vendors during the year for 86,000 acres, purchased at a cost of $498,000.

Most of the projects under the old program, established in cooperation with other Federal agencies for use primarily as migratory waterfowl refuges, recreational areas, and for additions to Indian reservations, were transferred to those agencies prior to transfer of the title III program to the Service. The remaining projects under the old program were of the agricultural-demonstration or multiple land use type sponsored by the Agricultural Adjustment Administration. Arrangements were made, or are under consideration, for the administration of these projects by those Federal and State agencies whose functions and facilities are appropriate for their management. The Service has retained administration of lands in projects developed mainly for grazing or a combination of grazing and other use. These lands are intermingled with adjacent and surrounding private lands or are closely associated with their farming economy.

Approximately 475,000 acres acquired under the old program were transferred to other Federal agencies, and 620,000 acres were leased to State agencies under long-time cooperative agreements. Still under the administration of the Service at the end of the year were 5,749,000 acres acquired under the old program, including some public-domain lands transferred for administration under title III. In addition, the Service had custodianship of about 333,000 acres in projects transferred to States.

The use of relief funds for the purchase of land under the old program was contingent on its need in connection with a work-relief program. The projects afforded employment for a large number of people on relief in the project areas and permitted an extensive program of land conservation and improvement.

The development program previously initiated on the multiple-use projects was carried forward on 84 projects. Approximately $9,800,000 of P. W. A. and W. P. A. funds were spent on improvements on these projects, including the demolition of unnecessary buildings and structures, erosion control, fire control, restoration of vegetational cover, and construction of administrative facilities such as truck trails, fences, and telephone lines. As of June 30, approximately $67,500,000 had been spent principally from relief appropriations for the development of 7,060,000 acres in 94 of the 98 multiple-use projects established under the old program.

During the year, 29 projects were initiated under the new program, bringing the total to 48. Acquisition of land in these projects was limited to the minimum necessary to bring about permanent economic rehabilitation of the rural areas and communties involved, and the retention of as many farm families in the areas as proper utilization of resources will continuously support. Development of these lands is being pointed toward those uses for which the lands are best adapted and which will result in the greatest benefit to the families

remaining in the areas. The Farm Security Administration provided guidance and financial assistance, where necessary, to enable families to relocate under conditions offering them a basis for improving their economic and social status.

Commitments were made for the purchase of 1,590,565 acres under the new program at an average price of $3.88 per acre. Considerable additional acreage was appraised and optioned. Development work was carried forward on 12 projects initiated under the new program.

PHYSICAL SURVEYS

As a natural corollary of the expanded scope of Service activities, survey work developed both extensively and intensively. Cooperation with an increasing number of soil conservation districts brought a corresponding increase in survey requirements. New emphasis in the Department on land use planning gave further impetus to Service survey activities. Along with other agencies of the Department, the Service continued survey activities in a number of watersheds of the country in connection with the Omnibus Flood Control Act of 1936, and subsequent amendments to it. At the same time, surveys continued as a prerequisite of operations in new C. C. C. work areas and demonstration projects of the Service.

Detailed field mapping in connection with 148 different surveys, covering 19,743 square miles, was completed. Of this area, 10,446 square miles were in 90 soil conservation districts, 110 square miles in private-land demonstration projects, and 713 square miles in public-land projects. Detailed mapping of watersheds, counties, or other selected areas not included in soil conservation districts covered 6,063 square miles. In addition, a substantial aggregate area was surveyed in connection with land-utilization projects, flood surveys, development of water facilities, and other cooperative projects.

Reconnaissance surveys were continued as a source of information regarding general erosion conditions in areas where field work is contemplated in erosion control, upstream flood control, and other activities involving better use of land. Reconnaisance mapping was completed on 11 different surveys, including 4 demonstration projects located on public land. A total of 19,128 square miles was mapped on a reconnaissance basis.

A scale of 4 inches to the mile has been adopted for most of the detailed mapping. Except in localities where variations in soil or slope are extremely complex, it was found that information on land conditions, necessary for detailed farm planning, can be recorded satisfactorily upon such a map. This scale, however, proved too small for outlining the actual reorganization of a farm, and the maps must be enlarged before they can be used by technicians for farm planning. Enlargement by photographic methods, although subject to some disadvantages, proved satisfactory for the purpose.

Conservation surveys were developed in response to the need for a complete physical inventory of the land, more precise and on a larger scale than the usual soil map, to be used as a definite physical basis for the planning of measures and practices on individual farms for control of soil and water and for better use of the land. With the three physical factors of soil type, slope, and existing erosion expressed separately and mapped in relation to the present land use,

planning technicians are able to fit their recommendations to the variations in these factors—in other words, to find out and recommend for every acre of land the best use that is justified by its capability.

The method devised for classification of land according to use capability includes the following categories: Land suitable for cultivation without special practices, land suitable for cultivation with simple practices, land suitable for cultivation with complex or intensive practices, land not suitable for continuous cultivation, and land not suitable for cultivation. This classification was adopted by several soil-conservation districts.

Particular attention was devoted to the development of maps showing physical conditions grouped into classes of land according to safe and permanent use. For the sake of brevity, these are referred to as land use capabilities maps.

Seven printed reports on erosion and land use conditions, based on the results of conservation surveys, were distributed by the Service. Two of the reports cover demonstration project areas, four are watershed surveys, one of which covers the drainage basin of a reservoir in which studies of sedimentation are being conducted, and the seventh is a reconnaissance survey of four North Dakota counties.

In the field of flood control, the Service, in cooperation with the Forest Service and the Bureau of Agricultural Economics, completed preliminary examination reports for run-off and water-flow retardation and soil-erosion prevention on 48 watersheds. Preliminary examinations were undertaken on approximately 50 additional drainage basins. Intensive surveys to determine watershed-protection measures needed in the interest of flood control were initiated on 18 watersheds, and 3 were completed.

Ground-control surveys were completed for 12,074 square miles, and covered 10 widely scattered areas throughout the country. General traverse and triangulation computations, with the reduction of geodetic coordinates to plane coordinates for all positions obtained, were completed on 14,554 square miles and covered 11 projects. Radial control work was finished on 8,565 square miles in 17 areas.

Specifications were prepared and arrangements made for awarding contracts for aerial and photogrammetric surveys of approximately 24,500 square miles in Texas, New Mexico, Arizona, Oregon, and Idaho. Contracts awarded by other bureaus in the Department were extended to include aerial surveys of approximately 6,000 square miles desired by the Service in North Dakota, South Dakota, Oregon, Georgia, Texas, and Minnesota. Where commercial companies had previously photographed areas in which the Service was interested, these photographs were purchased directly from the companies. Purchases of this kind covered approximately 51,000 square miles. Because of the large aerial-survey program of other bureaus in the Department, it was possible to borrow aerial-photograph negatives and make photographs on most of the areas on which conservation surveys and field operations were initiated.

During the year 155,300 aerial photographs were made in the Service laboratory. An underground film-storage vault of 10 compartments was constructed by the Service on the grounds of the Abingdon Research Center. Approximately half of the compartments were used by the Agricultural Adjustment Administration

and the remainder by the Service for the joint storage of nitrate film. Contracts were awarded for necessary equipment to install small aerial photographic laboratories in all regions of the Service. Such laboratories began operation in the southeastern, western Gulf, and the upper Mississippi regions.

COOPERATIVE RELATIONS AND PLANNING

With the reorganization of the Department and the assignment of new duties to the Service, cooperative relationships with local, State, and Federal agencies became more important than ever before to the harmonious and effective conduct of Service activities. The complexities involved in advancing conservation and better land use emphasized the need for development of long-range programs, and for practical procedures by which such programs could be carried out.

Memoranda of understanding or other instruments providing for cooperative work with 46 State extension services were in effect at the end of the year. Under these cooperative arrangements, 46 cooperative agents, generally known as extension soil conservationists, were employed in 33 States.

Approximately 5,000 educational meetings were held with farmer organizations, schools, organized soil conservation district groups, and others. Tours to Service projects, camp work areas, erosion experiment stations, soil conservation districts, and extension demonstration farms, were conducted by the Extension Service and representatives of other agencies under the leadership of the extension soil conservationists. Many of the meetings and tours were carried on in cooperation with field representatives of the Service. Bulletins, pamphlets, charts, graphs, film strips, slides, and photographs were made available to those participating in soil conservation educational work in the field.

In cooperation with the State extension services, approximately 1,600 farms have been selected as demonstration farms in areas outside camp, project, and soil conservation district areas. Complete farm plans have been formulated for these farms by Service technicians and local county agents under the leadership of State extension soil conservationists. The principles of a well-coordinated program of soil conservation and proper land use were demonstrated on these farms in 36 States.

In addition to the cooperative work with State agencies, the Service assisted the Solicitor's office in reviewing proposed and new legislation relating to conservation and land use, helped develop cooperative arrangements for assisting soil conservation districts and other local State agencies, and took steps to coordinate its activities more completely with those of the Agricultural Adjustment Administration, the Farm Security Administration, the Bureau of Agricultural Economics, the Tennessee Valley Authority, and other Federal and State agencies.

In cooperation with the Solicitor, the standard State soil conservation districts law was adapted to the constitutional and organizational requirements of a number of States and served as a basis for appropriate legislation for soil erosion control. Soil conservation district laws, somewhat similar to the standard State soil conserva-

tion districts law, were enacted in 10 States during the year, making a total of 36 States which have enacted a soil conservation districts law along the line of this law.

Authenticated copies of soil conservation district laws, as enacted in the respective States, were procured for the use of the Department. In cooperation with the Solicitor, the administrative and legal adequacy of each of the laws has been studied to determine whether it provides an adequate basis for departmental cooperation with soil conservation districts organized thereunder.

A current file of legislation dealing with the conservation of soil and soil resources and zoning of agricultural lands, as are now set forth on the statute books of the several States, was maintained by the Service as an aid in developing action plans for soil conservation in the several States.

INFORMATION AND EDUCATION

Mounting public interest in soil conservation and better use of land, coupled with the development of soil conservation districts and the extension of governmental activity in the field of land use, brought a substantial increase in the demand for accurate, authoritative information on all phases of the subject. To meet these demands and discharge the responsibility of the Service for providing useful information to the public on soil conservation and its related fields, an increased amount of material was prepared and disseminated.

This dissemination of information was accomplished through working relationships with the press and with radio-broadcasting outlets, through the preparation and distribution of bulletins, and through the development and utilization of exhibits, motion pictures, and related media of visual information. As in the past, established outlets for agricultural information in each State were utilized to the fullest possible extent and working relationships with extension editors in most States were strengthened.

Increasing interest of educators in soil conservation and better use of land was reflected in frequent requests for teaching material and for cooperation in the development of courses and texts on the subject. General and technical information suitable for teaching purposes in schools and universities, both rural and urban, was made available on request.

Press and radio activity reflected the expanded scope of the Service program. Press releases dealing with demonstration projects and C. C. C. camps decreased in number, while there was an increase in the information relating to cooperative work with soil conservation districts. Developments in the submarginal-land purchase and development and water-facilities programs were regularly reported to the public, both in Washington and in the field. Items of purely local interest continued to flow from various work units directly to nearby newspapers, while information of State-wide and regional interest was prepared by the regional information staffs and disseminated, in most cases, through State extension editors.

Several regions initiated a photographic mat service and provided illustrated feature material to a number of farm journals on a more or less regular schedule. Partially as a result of this service, the

number of soil conservation editions increased. The Washington information staff continued to prepare information on national developments in the soil conservation program, including announcements of selection of new work areas, expenditure of funds, progress in research, and administrative actions. This material was released to correspondents and syndicate services through the Press Service of the Department.

The trend of Service radio activity was toward a greater degree of participation in well-established agricultural programs. Regular periods were set aside for conservation discussions by Service personnel on 23 such programs over the country. In addition, a number of radio stations continued to reserve certain periods especially for broadcasts on soil conservation.

Perhaps the most noteworthy of these broadcasts was Fortunes Washed Away, a series of dramatic programs presented weekly over station WLW at Cincinnati. Brief items on Service progress and on timely erosion-control topics were prepared as Farm Flashes, in several regional offices for the first time, and sent to State extension editors for distribution to broadcasting stations. Meanwhile, the Washington staff continued to submit Farm Flashes for distribution through the Radio Service of the Department.

Service participation on the National Farm and Home Program was on much the same basis as during the previous year. Short talks were made approximately once each week by members of the Washington staff. Longer programs, centered around the soil conservation problems of a particular farming region, were presented monthly over the Farm and Home network from Washington, Chicago, Denver, Los Angeles, and San Francisco.

The Service also took part in a series of radio broadcasts sponsored and arranged in the several States by the National Emergency Council.

The number of Service publications printed and in process of publication was doubled over the past year. Compared to 20 publications on or off the press on July 1, 1938, 22 publications were printed and 19 manuscripts were at the Government Printing Office on July 1, 1939. This rise in the number of publications corresponds closely to the increasing distribution of Service bulletins, which rose from 518,997 to 1,005,895 within the year.

The 22 published bulletins of the year include 3 Farmers' Bulletins, 4 Miscellaneous Publications, 7 reports on erosion and related land use conditions, 3 Leaflets, 3 unnumbered publications, 1 Technical Bulletin, and 1 Circular. The preparation of practical, popular bulletins to meet the demand of the farmer for specific information on erosion control has been emphasized, but the preparation of important scientific bulletins has also continued.

A national picture of soil erosion, region by region, appeared in To Hold This Soil, Miscellaneous Publication No. 321. The demand for this publication required its reprinting within a few months. The problems and methods of soil conservation in the South and in the Northeast were described in detail in Farmers' Bulletins Nos. 1809 and 1810. Those of the southern Plains and of the farm and range of the Southwest were described in Miscellaneous Publications Nos. 334 and 338. This series of regional publications now covers seven

of the important agricultural regions of the United States, and two more are in process of publication.

Practical examples of effective conservation cooperation by neighbors, and an explanation of potential advantages in soil conservation districts, are presented in From Ridge to River, an unnumbered publication from the Upper Mississippi Valley Region. Problem-area groups of land in the southern Great Plains are dealt with in another unnumbered publication. For the picture-minded, An Outline of the Water Facilities Program (unnumbered) was published.

Of scientific and practical value is Miscellaneous Publication No. 303, which contains the most complete and authentic list and description yet published of native woody plants of the United States, and gives their importance in erosion control and for wildlife. The demand for this bulletin made a reprint necessary. A Farmers' Bulletin of scientific as well as practical value, Native and Adapted Grasses for Conservation of Soil and Moisture in the Great Plains and Western States, Farmers' Bulletin No. 1812, was published. Other scientific publications of the year included Technical Bulletin No. 633, Principles of Gully Erosion in the Piedmont of South Carolina, and Circular No. 490, Soil Erosion in the Karst Lands of Kentucky. A 650-page bibliography on soil erosion and soil and water conservation was issued in October 1938.

The following leaflets were printed: No. 164, Erosion on Roads and Adjacent Lands; No. 165, Soil-Depleting, Soil-Conserving, and Soil-Building Crops; and No. 163, Legumes in Soil Conservation Practices.

Soil Conservation, the official organ of the Service, completed its fourth year of publication. Six of the twelve monthly issues were sharply specialized, and dealt with land use programs, land use planning, controlled grazing, soil conservation engineering, wildlife, and soil conservation districts in Georgia and Arkansas.

In July and August the magazine carried articles not only from the Service but from the Secretary, the Under Secretary, the Coordinator of Land Use Planning, Administrators of the Agricultural Adjustment Administration and the Farm Security Administration, and Chiefs of the Bureau of Agricultural Economics, Bureau of Public Roads, Forest Service, and Bureau of Biological Survey. Increasingly, Soil Conservation was used by the Department as a medium to inform its personnel on developments in the physical-action program on agricultural lands.

As a reference source, the magazine proved valuable to botanical gardens, natural-history museums, Audubon societies, State conservation departments, scientific laboratories, and libraries in the United States and many foreign lands.

Volume IV contained 99 signed articles by 87 different authors, also a large number of unsigned items and administrative notes. Free distribution averaged 5,900 copies per month; paid subscribers reported by the Superintendent of Documents numbered 417 at the end of the year. The demand for free copies far exceeded the supply.

Service News, a mimeographed administrative publication, was issued at intervals of from 1 to 2 weeks. Its circulation was entirely among employees of the Service.

In the field of visual information, particular attention was given to the preparation of visual materials needed by colleges, schools, county agents, educational conference leaders, supervisors in soil conservation districts, and others primarily interested in educational work in soil conservation.

Seven film strips were completed and released for distribution; one strip was made in natural color. Seven additional strips were in the hands of the processing firm at the close of the year. A definite increase was noted in the use of film strips by educational institutions and organizations, and a procedure was set up whereby regional laboratories were able to make strips covering subject matter of a given locality. Field camera work was completed on two motion pictures, and camera work was started on a third.

Fourteen pictorial charts, designed primarily for use in school, college, and group educational programs, were completed and distributed. Eleven additional charts were in the hands of the Public Printer.

There was a decided uptrend in requests for Service pictures for use in textbooks, popular books, encyclopedias, magazines, periodicals, and newspapers. Full-page rotogravure lay-outs were published in the metropolitan newspapers in all sections of the country. Photographic costs were reduced and the quality of pictures improved under a system of planned photography put into effect in each field unit.

The continued use and development of small, portable exhibits gave the Service the cumulative benefit of a year-round exhibits program in preference to one built strictly around local fairs and meetings. Best estimates indicated that approximately 15,000,000 persons saw and studied the small exhibits of the Service.

ADMINISTRATION

Steps toward a desirable decentralization of administrative authorities in personnel, training, and business-management functions marked the administrative year of the Service. Procedures for more efficient use of equipment were developed. The technical quality of fiscal work was improved, and a study of the classification of Service personnel was initiated. Perfections in administrative procedures, made possible by the consolidation last year of all administrative functions in a single division, were continued throughout the Service. Similarly, the consolidation into one administrative unit of a number of facilitating organization services, such as procurement, equipment control, property inventories, mimeographing, messenger service, maintenance of files, automotive service, and patent work, resulted in a more efficient and economical conduct of these functions.

Equipment surpluses were concentrated and placed under regional control, permitting a redistribution of available property throughout the various regions and greater economy in conduct of the program. Progress was made toward reducing purchases and the disposal of items for which a future need could not be foreseen. Elimination of a number of storage spaces at individual projects and work-unit locations brought operating economies.

Emphasis in personnel work was placed on organization and personnel classification activities following the transfer of the land

utilization and other programs to the Service in the fall of 1938. All positions in the Washington office were reviewed and, where necessary, reallocated. A similar classification and organization study was planned for the field service of the organization.

Expansion of Service activities by the Department reorganization increased the number of appointive personnel. Approximately 2,000 employees, formerly carried on informal field appointments in units transferred to the Service, were given formal appointments. Of this number, approximately 1,000 employed on P. W. A. projects conducted as part of the land utilization program were recommended to receive civil-service status as a result of Executive Order No. 7616, dated June 24, 1938.

A summary of personnel, including permanent, temporary, letter of authorization, and W. P. A., employed as of June 30, 1939, is given in table 16.

TABLE 16.—*Number of employees and funds from which paid, 1939*

Fund	Secretarial appointments	Letter of authorization	W. P. A. certified	Total
	Number	*Number*	*Number*	*Number*
Soil Conservation Service	9,464	3,826		13,290
Civilian Conservation Corps	4,000	106		4,106
Land Utilization and Public Works Administration	2,307	397		2,704
Emergency Relief Administration	118		17,896	18,014
Total	15,889	4,329	17,896	38,114

The employee training program of the Service was stimulated by the establishment of a training section in the Washington office under the direction of a training officer, and by the addition of regional training officers in the 10 regions. The President's Executive order of June 24, 1938, and the In-Service Training Committee report of the Department dated April 1939, emphasized the importance of employee training. Following the general concepts of the Department program and in conformity with the objectives and policies of the Service, a number of basic objectives and policies for the Service training program were adopted. The responsibility for C. C. C. enrollee training work was assigned, in the field, to the regional training officers.

Continued progress was made in the reduction of injuries and accident costs as shown by table 17 for the Service and the Civilian Conservation Corps, including enrollees.

TABLE 17.—*Lost-time injuries, and cost, 1939*

Period	Lost-time injuries	Lost-time injuries per 1,000,000 man-hours worked	Estimated cost
	Number	*Man-hours*	*Dollars*
1936-37	3,495	25.19	1,719,540
1937-38	1,959	16.56	963,828
1938-39	1,640	13.12	806,880

The reduction in accident costs may be attributed to foremen and mechanics training activities, the follow-up and inspection of field safety committees, the awarding of certificates of merit, and a program of visual education in safety.

Complicated problems were presented to the fiscal agencies of the Service by the integration of various other programs with work formerly handled. Previous efforts to develop and maintain technical excellence of fiscal work throughout the Service facilitated integration of the additional programs from an administrative standpoint without confusion or appreciable loss of efficiency. Emphasis was placed on the establishment of uniform and efficient fiscal practices and procedures in the regional offices. A fiscal manual embodying the major legislative and regulatory requirements governing the conduct of financial activities of the Service was issued.

The 10 regional fiscal offices of the Service operated on a decentralized basis, maintaining allotment accounts, performing audit of vouchers, and conducting related fiscal matters under the control of the Washington fiscal office. Total funds for which the Service was accountable increased approximately 59 percent over the previous fiscal year. Funds available for the year were as follows:

Regular appropriation	$23,438,776
Submarginal-land purchase and development	11,700,315
Civilian Conservation Corps	9,933,360
Flood-control and water facilities funds	1,504,300
Emergency funds	15,599,708
Miscellaneous appropriations and funds	3,000
Total	62,179,459

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REPORT OF THE SOLICITOR, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SOLICITOR,
Washington, D. C., September 15, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the work of the Office of the Solicitor for the fiscal year ended June 30, 1939.

Respectfully yours,

MASTIN G. WHITE, *Solicitor.*

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ORGANIZATION CHANGES

During the year, several changes in the organization of the Office were effected.

ESTABLISHMENT OF THE SOLICITOR'S STAFF

The Solicitor's staff was established as an independent group within the Office of the Solicitor to assist the Solicitor in the conduct of affairs requiring a general perspective. Members of the staff have no supervisory control over, and are not responsible for, the operations of the several divisions, sections, units, or field branches of the Office. The duties of the several professional members of the staff are as follows:

1. The Assistant Solicitor, in addition to his regular duties as principal aide to the Solicitor, serves as staff consultant on matters affecting major technical and administrative operations of the Office and the organization and correlation of field activities of the Office.

2. A second member of the staff acts as consultant with respect to the regulatory phases of the work handled by the Office, especially with reference to the conduct and coordination of quasi-judicial and other formal proceedings.

3. A third staff attorney assists the Solicitor in connection with matters relating to the expenditure and handling of public funds and serves as a conferee on fiscal matters not requiring the personal attention of the Solicitor.

ABOLITION OF THE COMMUNITY PROJECT DIVISION

The Community Project Division was abolished, and its functions were integrated with those of the Farm Security Division. The Community Organization and the Community Management Sections of the dissolved Division, together with the Rehabilitation and Farm Loan Sections of the original Farm Security Division, retain their identity and constitute the present Farm Security Division.

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CREATION OF THE HEARING DIVISION

A new Division, known as the Hearing Division, was created for an experimental period. The members of the new Division are charged with the responsibility of conducting, as examiners, referees, and presiding officers, quasi-judicial proceedings in which representatives of the Department appear as interested parties. The hearing clerk unit, formerly attached to the Business Administration Section, was made a part of the Hearing Division. The changes referred to in this paragraph, which were suggested in the course of a study of the practice and procedure governing the formal hearings conducted by the Department, are described later in some detail in connection with the discussion of that study.

PERSONNEL

At the close of the year, there were in the Office 146 professional, 2 subprofessional, 228 clerical, and 11 custodial employees stationed in Washington, and 87 professional and 98 clerical employees stationed in the field, making a total of 572 employees.

GENERAL SUMMARY OF WORK

Over 1,000 formal opinions on legal questions were rendered by the Solicitor to administrative officials of the Department. It was not feasible to keep a record of the oral and informal written legal advice given from day to day to departmental officials.

There were prepared, for prosecution by the Department of Justice, 1,161 alleged violations of regulatory statutes entrusted to this Department for administration and enforcement. In addition, the facts of many apparent violations of these statutes were submitted to the Office and were given careful consideration, but the facts submitted were not, and apparently could not be made, convincing enough to warrant prosecution, hence they were not submitted to the Department of Justice.

Table 1 shows the data regarding the penal cases, involving statutes administered by this Department, which were successfully prosecuted during the year.

TABLE 1.—*Cases in which fines, penalties, or damages were recovered*

Law involved	Cases	Amount paid
	Number	*Dollars*
Agricultural Marketing Agreement Act of 1937	6	1,150.00
Animal quarantine acts	8	1,400.00
Bird and Animal Reservation Trespass Act	16	201.00
Commodity Exchange Act	1	25.00
Federal Caustic Poison Act	1	50.00
Federal Food, Drug, and Cosmetic Act	1	3,450.00
Food and Drugs Act	210	56,209.05
Insecticide Act	39	5,207.00
Lacey Act	17	1,460.00
National-forest laws	804	49,909.07
Meat Inspection Act	35	1,785.00
Migratory Bird Conservation Act	3	215.00
Migratory Bird Hunting Stamp Act	80	590.00
Migratory Bird Treaty Act	557	18,430.50
Packers and Stockyards Act	8	1,025.00
Perishable Agricultural Commodities Act	13	6,879.66
The 28-hour law	137	14,200.00
United States Warehouse Act	1	500.00
Upper Mississippi Wild Life and Fish Refuge Act	6	210.00
Total	1,943	162,896.28

In addition to the cases listed in table 1, 2,708 decrees of condemnation were entered as a result of violations of the Food and Drugs Act, Federal Caustic Poison Act, Insecticide Act, and Federal Food, Drug, and Cosmetic Act.

There were 2,545 notices of judgment prepared for publication, under authority of the Food and Drugs Act, Insecticide Act, and Federal Caustic Poison Act.

Table 2 summarizes the number of contracts and leases which were prepared or reviewed in the Office.

TABLE 2.—*Contracts and leases prepared or reviewed*

Bureau or office	Contracts	Leases [1]	Total
	Number	*Number*	*Number*
Agricultural Adjustment Administration	21	49	70
Agricultural Economics	22	64	86
Agricultural Engineering	0	2	2
Agricultural Research Center	12	0	12
Animal Industry	10	29	39
Biological Survey	18	9	27
Central Supply	16	0	16
Chemistry and Soils	2	5	7
Commodity Exchange Administration	0	9	9
Dairy Industry	1	1	2
Etomology and Plant Quarantine	5	77	82
Experiment Stations	1	1	2
Extension Service	1	0	1
Farm Security Administration	1,028	3,390	4,418
Federal Crop Insurance Corporation	0	10	10
Food and Drug Administration	2	0	2
Forest Service	639	759	1,398
Home Economics	1	1	2
Plant Industry	11	7	18
Public Roads	5,726	14	5,740
Soil Conservation Service	5	258	263
Solicitor	2	4	6
Weather	63	39	102
Total	7,586	4,728	12,314

[1] The duties incident to the preparation of many types of leases were transferred to the Office of Plant and Operations on Apr. 16, 1939. However, all leases prepared by the Office of Plant and Operations were examined for legal sufficiency in this Office.

STUDY OF ADMINISTRATIVE PROCEDURE AND PRACTICE

An especial feature of the activities of the Office during the past year has been the study made of the practice and procedure governing the administrative hearings conducted by the Department under the numerous regulatory statutes administered by the Secretary. The study was begun in September 1938 and will continue during the fiscal year ending June 30, 1940.

The Department of Agriculture is required by law to administer a greater number of statutes of a regulatory character than any other single agency of the Government. As a result of the large number of statutory provisions for notice and hearing prerequisite to regulatory activity, and as a consequence also of the special procedures apparently demanded by the language of such statutes, the rules of practice devised by the Department from time to time appear to be unnecessarily elaborate and to lack coordination. Accordingly, a chief objective of the study of the Department procedure has been to determine to what extent the different procedures may be simplified and, without losing sight of the demands of realistic administration, to what extent they may be rendered more nearly uniform. A further purpose has been to inquire into the adequacy of existing practices and to suggest a mode of correction of such deficiencies as might be discovered.

To achieve such objectives within any reasonable length of time, it was obvious at the outset that exhaustive examination of the procedures established to govern all of the hearings held by the Department would be impossible and that thorough study of only the principal and typical regulatory statutes could profitably be accomplished. Toward that end the following statutes were selected for study, in the order named: The Agricultural Marketing Agreement Act of 1937; the Packers and Stockyards Act, 1921; the Commodity Exchange Act; the Perishable Agricultural Commodities Act, 1930; the Sugar Act of 1937; and the Federal Food, Drug, and Cosmetic Act. Studies of the first two, i. e., the Agricultural Marketing Agreement Act of 1937 and the Packers and Stockyards Act, 1921, have been completed. Mimeographed copies of these two studies were placed in the hands of persons in and outside the Department who, either because of their general knowledge of administrative law and procedure or because of their special knowledge of the subject matter of the two statutes, might be able

to make critical appraisals of the studies and to offer helpful suggestions for the studies to follow. Substantial progress has been made in the studies of the Commodity Exchange Act and the Perishable Agricultural Commodities Act, 1930.

Concurrently with the inquiry into the procedures established by the Department to govern hearings under particular statutes, considerable attention was devoted to a number of other matters more or less closely allied to the subject matter of the study. Such matters are discussed in the following paragraphs.

NEW RULES OF PRACTICE FOR PARTICULAR HEARINGS

During the year, the Department prepared and announced various rules of practice to govern hearings for which either no written procedure had previously been promulgated or for which the existing rules of practice needed revision. In one instance, in the case of the rules of practice issued January 13, 1939, to govern hearings under section 701 (e) of the Federal Food, Drug, and Cosmetic Act, the procedure announced was the first to be issued to govern any phase of such hearings. In other instances, such as with respect to the proceeding under the Packers and Stockyards Act, 1921, to determine the equitable distribution of the fund impounded by the court in the case of *Morgan* v. *United States* (304 U. S. 23; also 8 F. Supp. 766), and with respect to the procedure to govern the motion to dismiss filed by the respondent in the proceeding under section 6 (a) of the Commodity Exchange Act, entitled "*Cargill, Inc.*, v. *Chicago Board of Trade*, CE–A6," the existing rules of practice made no provision for such special procedures. In still another instance, that relating to hearings under section 205 of the Sugar Act of 1937, the prevailing rules of practice were revised.

THE HEARING CLERK

Because of the confusion which frequently resulted from the fact that there was no single official within the Department to serve as the custodian of official records and documents relating to the various formal hearings conducted by the Department, it was deemed desirable to establish a hearing clerk for the Department as a whole. Such an official had been designated and was functioning with respect to hearings held under the Agricultural Marketing Agreement Act of 1937 and the Sugar Act of 1937, but the duties of a hearing clerk with respect to other hearings conducted by the Department were distributed among a number of individuals in the Office. In order to concentrate all such work in one place, therefore, the duties of the hearing clerk established in connection with the hearings under the two statutes previously named were extended, by an order of the Secretary issued February 8, 1939, so as to include all formal hearings conducted by the Department. All official papers and documents relating to departmental hearings arising since that date have been filed with, and kept in the custody of, the hearing clerk in this Office.

CHANGES BASED UPON A CLASSIFICATION OF TYPES OF DEPARTMENTAL PROCEEDINGS

Administrative agencies in general, not excepting the Department of Agriculture, have in the past few years been subjected to increasing criticism for their alleged failure to observe the spirit of the judicial principle of fair play in adversary proceedings, i. e., quasi-judicial proceedings in which administrative agencies appear as advocates and also decide the issues. It has been charged that this principle has been violated in such proceedings, in that (1) agencies have frequently confused their functions by combining in the same officers or employees the roles of prosecutor and judge, and (2) the heads of the agencies have frequently relied upon ex parte conferences and consultations with departmental subordinates concerning the substance of final administrative orders. (See the several pronouncements of the Supreme Court in the case of *Morgan* v. *United States* (298 U. S. 468; 304 U. S. 1; 304 U. S. 23).)

Partly to meet such criticism, and partly also to define more closely the respective duties of the various officials of the Department with respect to the conduct of hearings, a tentative classification of the types of proceedings conducted by the Department was undertaken, and various intradepartmental arrangements were made, based upon such classification. According to the classification announced, the principal proceedings conducted by the Department may be grouped into two categories, A and B. Group A, embracing roughly the proceedings where the Department acts exclusively in a single governmental capacity, i. e., either legislative, judicial, or executive, includes (1) reparation pro-

ceedings, and (2) proceedings to afford a basis for making general rules, regulations, standards, etc. Group B, the so-called adversary proceedings, embracing roughly the proceedings in which the Department combines judicial functions with other types of governmental functions, includes the following: (1) Proceedings for issuance of cease and desist orders; (2) proceedings to issue, refuse, suspend, or revoke licenses, permits, certificates, etc.; (3) proceedings to determine whether a petitioner should be exempted from a departmental order; (4) proceedings to determine whether to recommend prosecution of the respondent to the Attorney General; (5) rate-making proceedings; and (6) proceedings for allotment of quotas (when the Department appears as an advocate).

Based upon the classification of proceedings just described, certain changes in departmental procedure were effected:

THE HEARING DIVISION

For an experimental period of 1 year beginning May 18, 1939, there was established within the Office a new Division, known as the Hearing Division, composed of four attorneys who had customarily been engaged in acting as examiners, presiding officers, or referees in certain departmental proceedings, and headed by an attorney with extensive experience as an examiner and with wide knowledge of the subject matter of the regulatory statutes administered by the Department. In view of the serious administrative problems involved in the creation of this Division, it was determined not merely to limit its present establishment to an experimental period of 1 year but also to restrict its jurisdiction to such proceedings of the types set forth in group B as might arise under the Packers and Stockyards Act, 1921, the Perishable Agricultural Commodities Act, 1930, the Commodity Exchange Act, and the Agricultural Marketing Agreement Act of 1937.

Subject to such limitations, the Hearing Division is charged with the responsibility of presiding over and conducting the hearings held by the Department. The members of the Hearing Division act only as examiners, referees, and presiding officers and never participate in hearings as advocates. In all hearings over which members of this Division preside, the Department is represented by attorneys designated by the Solicitor.

ROUTING OF FINAL ORDERS OF THE SECRETARY

Closely related to the problems which gave rise to the establishment of the Hearing Division was the situation likewise raised in the case of *Morgan* v. *United States*, supra, as to the extent to which the Secretary, in promulgating a final order or determination upon the basis of a record made at a formal hearing, may entertain the counsel and assistance of departmental subordinates, without prejudicing the interests of adverse parties. As a practical interpretation of this problem, this Office advised the Secretary that, while he should not, in any such proceeding, receive from any employee of the Department evidence which is outside the written record, he should feel free to consult with any employee of the Department concerning the substance of any final order at any stage of the proceeding leading to the issuance of such order, with respect to departmental proceedings falling within group A of the classification described above. As to an adversary proceeding in group B, the Secretary was advised that he should not, in the absence of the adverse party or his representative, discuss matters of substance with any employee of the Department, other than the examiner, referee, or presiding officer who presided over the hearing in the Secretary's stead.

PROPOSED LEGISLATION TO AUTHORIZE THE SECRETARY TO DELEGATE QUASI-JUDICIAL FUNCTIONS

The constant expansion of the regulatory responsibilities of the Department over the years has increased the general burden upon the persons of the Secretary, the Under Secretary, and the Assistant Secretary, but the administrative burden upon those officials has been especially increased by the expansion insofar as the discharge of quasi-judicial functions is concerned. To alleviate this condition, Congress was requested, upon the basis of material compiled in the Office, to enact legislation which would enable the Secretary upon occasion to delegate to other officials and employees of the Department authority to issue regulatory orders having the force and effect of law and issuable only after notice and hearing have been allowed to the parties affected. As of June 30,

1939, bills were pending in Congress for this purpose, that in the House of Representatives (H. R. 5032) proposing to authorize such a delegation to any one of a fairly large group of responsible departmental officials, and that in the Senate (S. 1955) proposing to create the position of Second Assistant Secretary of Agriculture, the occupant of which position might be the recipient of such authority and could act only with respect thereto.

PREPARATION OF REPORT UPON PENDING BILLS CONCERNING ADMINISTRATIVE PROCEDURE

A considerable amount of work was required in connection with the formulation and presentation of the position of the Department in response to legislation proposed by the American Bar Association to revise and standardize Federal administrative procedure and judicial review of administrative action. After much research on the proposed legislation and its probable effect upon the work of the Department, a lengthy report was prepared in the Office and transmitted to Congress, strongly objecting to the enactment of the proposed legislation at this time and suggesting, as an alternative, that the pending bills (S. 915 and H. R. 6324) be passed over until the completion of the work of the Attorney General's Committee on Administrative Procedure, which was appointed at the suggestion of the President on February 24, 1939.

THE ATTORNEY GENERAL'S COMMITTEE ON ADMINISTRATIVE PROCEDURE

The establishment of the Attorney General's Committee on Administrative Procedure, has called for active participation by this Office. To assist that committee, there has been established a so-called advisory committee, composed of representatives from the principal bureaus or agencies of the Government. The Secretary has designated representatives from seven of the Department bureaus to serve on the advisory committee and has designated a member of this Office to act as the general representative of the Department on the committee and as chairman of the intradepartmental committee. It is expected that a considerable amount of research and other effort will be required of the departmental and bureau representatives in this connection.

AGRICULTURAL ADJUSTMENT DIVISION

CONSERVATION PROGRAMS

An important part of the work of this Office revolves around the legal problems incident to the programs formulated and administered under the authority of sections 7 to 17 of the Soil Conservation and Domestic Allotment Act, as amended. The programs carried out under this act are of three principal classes: (1) Agricultural conservation programs; (2) range conservation programs; and (3) naval stores conservation programs.

Participating in these various programs are, roughly speaking, some 6,000,000 farmers. These farmers operate under the most diverse human, climatic, and geographic conditions. Because of the problems, both economic and sociological, presented by this diversity of conditions, and because of the difficulty involved in dealing with such an unprecedented number of individuals in the administration of the conservation and allied programs, it has been necessary to develop new administrative tools. This pioneering administrative process has presented innumerable legal problems the solution of which, for the most part, has not been aided by legal precedent. For example, in the administration of these programs, it has been necessary to establish and utilize, as administrative assistants, some 3,000 county agricultural conservation committees. The legal status of these committees, partly private and partly public, is difficult to define adequately. A great number of legal problems have grown out of the uncertainty surrounding the hybrid characteristics of these committees—problems, in many instances, requiring consideration of obscure points of law only tangent to the orthodox fields of constitutional and administrative law. The situations growing out of the utilization of county committees by the Secretary in administering these programs are merely illustrative of many other situations in which such administration has presented novel and complex legal problems. For example, experience has shown that the impact of State police and taxing laws upon various details of the conservation programs requires the consideration, by this Office, of many important constitutional problems.

This Office has, at all times, participated in the drafting of basic regulations and detailed procedure for carrying out the Soil Conservation and Domestic

Allotment Act, as amended, and related acts. The preparation of these regulations and procedures, covering, as they do, a relatively new area of governmental activity, has presented legal problems requiring, in many cases, detailed study and research.

AGRICULTURAL ADJUSTMENT ACT OF 1938

Under the Agricultural Adjustment Act of 1938, as amended, acreage allotments were fixed by the Secretary of Agriculture for wheat, cotton, corn, rice, and tobacco, and marketing quotas for cotton and tobacco were proclaimed and effected, with the approval of producers through referendums. The drafting of regulations and procedures under the Agricultural Adjustment Act of 1938, as amended, called for much legal drafting and, concomitantly, considerable legal study and research.

Under section 372 (c) of title III of the Agricultural Adjustment Act of 1938, as amended, this Office assisted in the preparation of regulations and forms pertaining to the refund of penalties erroneously, illegally, or wrongfully collected by the Secretary with respect to the marketing of tobacco or cotton. In this connection, a number of claims for the refund of tobacco-marketing penalties were considered by this Office.

CASES OF INTEREST

Shortly prior to the beginning of the marketing season of 1938–1939 for flue-cured tobacco, several cases were instituted in State courts by producers of such tobacco against tobacco auction warehousemen. The producers sought to restrain the warehousemen from deducting and paying over to the Secretary of Agriculture the penalty fixed by the statute with respect to tobacco sold in excess of the marketing quotas established for the farms of the producers.

James H. Mulford et al. v. *Nat Smith et al.* was one of such cases. Upon removal of this case to the United States District Court for the Middle District of Georgia, the United States intervened as defendant. Soon thereafter, a hearing took place before a specially organized district court consisting of three judges. This court sustained the constitutional validity of the provisions of the act relating to farm marketing quotas for flue-cured tobacco.

The decree of the district court was affirmed by the United States Supreme Court in its opinion rendered April 17, 1939 (307 U. S. 38). The Court examined the applicable provisions of the act and found them to be valid. The decision established the following propositions:

1. The applicable provisions of the act are regulations of interstate and foreign commerce within the power given to Congress by the Constitution.
2. The applicable provisions of the act are not so indefinite as to deny due process of law or to vest unconstitutionally any legislative power in the Secretary of Agriculture.
3. The provisions of the act for the establishment of farm marketing quotas for the 1938 crop, while entailing some hardship on growers who had already planted tobacco, did not operate to deprive them of property without due process of law.

The case of *Troppy* v. *Lasara Farmers Gin Co., Inc., et al., United States Intervening*, was pending for decision at the close of the year in the United States District Court for the Southern District of Texas. In this case, the plaintiff challenges the constitutional validity of the cotton-marketing-quota provisions of the Agricultural Adjustment Act of 1938, as amended, and demands a judgment against the defendant ginners for an amount of money withheld by them as penalties, as provided for in the act, on the sale to the ginners by the plaintiff of cotton in excess of farm marketing quotas established under the act for the marketing year 1938–1939 for farms operated by the plaintiff in Willacy County, Tex.

The plaintiff alleges as the ground for recovery that the applicable provisions of the act constitute a regulation of the production of cotton and not a regulation of interstate and foreign commerce. It is also claimed that the regulation, even if regarded as a Federal commerce regulation, is invalid as to local sales of cotton, notwithstanding the fact that the cotton may ultimately move in interstate and foreign commerce. In these two respects, it is said that the regulation constitutes an invasion of the powers reserved to the States under the tenth amendment to the Constitution.

The defendant ginners deposited the money for which this judgment is sought in the registry of the court to abide the judgment of the court. The

United States intervened under the provisions of section 1 of the act of August 24, 1937 (50 Stat. 751; 28 U. S. C., Supp. III, sec. 401), for the purpose of defending the constitutional validity of the cotton-marketing-quota provisions of the act. The case was argued before the court on May 26, 1939, on a stipulation of facts.

SUGAR ACT OF 1937

In general, the sugar program during the fiscal year was a continuance of the principles embodied in programs carried out under the Jones-Costigan Act. This act, except for certain provisions which were invalidated by the Supreme Court of the United States in the *Butler* case, was repealed by the Sugar Act of 1937.

This Office performs all the legal work incident to both the regulatory and nonregulatory provisions of the Sugar Act of 1937. This legal work involves a consideration of many fundamental problems of administrative law. Particularly is this true with respect to problems arising out of the quasi-judicial hearings held for the purpose of the allocation of the various quotas. A great amount of detailed legal work is also involved in the administration of this act. The complex administrative problems arising from a more or less detailed administrative control over the entire sugar industry necessarily presents legal problems of great variety.

This Office, of course, participated in the drafting of regulations and procedures necessary for the implementation of the Sugar Act. In this connection, a great deal of careful research was necessary in the drafting of the procedure for the conduct of hearings preceding the allocation of the various sugar quotas.

Representatives of this Office presided at the hearings held under the Sugar Act.

FEDERAL CROP INSURANCE ACT

This Office is responsible for all the legal work involved in the operation of the Federal wheat crop insurance program. In scope, this work covers an exceedingly wide range of legal activities. Most of the legal problems relating to the grain trade and many of those relating to warehouses were presented in the course of the operation of this program. Furthermore, because the Federal Crop Insurance Corporation is a governmental corporation and, as such, occupies a position between an orthodox business corporation and an executive department of the Federal Government, many fundamental constitutional problems have arisen involving conflicts between State and Federal sovereignties. In addition to these extremely important and fundamental legal problems, innumerable problems of corporation law, both governmental and private, have been dealt with by this Office in connection with the crop-insurance program.

In addition to the legal work mentioned above, perhaps the most important legal service that this Office performs for the Federal Crop Insurance Corporation is that involving matters of technical insurance law. In this connection, because the type of insurance dealt with by the corporation is, in a large measure, unique, this consideration of insurance law was frequently undertaken by this Office without the benefit of adequate legal precedent.

A great deal of time was spent in assisting with the drafting and development of regulations and procedures and related forms under the act. More specifically with respect to these forms, this Office developed various types of insurance contracts, storage agreements, indemnity agreements with railroads, and contracts in connection with the sale and purchase of wheat.

Approximately 4,500 documents and memorandums were written, or assistance was given to various administrative officials in the preparation thereof, in connection with the work of the Agricultural Adjustment Division.

CONSERVATION AND MARKETING DIVISION

NATIONAL FORESTS

One hundred and seventy-two claims to land within the national forests, initiated under the public land laws of the United States, were handled by the Office.

There were handled 1,527 bills, complaints, informations, protests, etc., affecting the national forests. In cases relating to the national forests, attorneys of the Office filed 36 briefs, attended 31 hearings, made 43 court appearances, prepared 11 stipulations, and handled 229 matters involving general litigation and settlement.

The total amounts of the fines imposed and the damages awarded in 804 trespass cases are shown in table 3.

TABLE 3.—*Damages and fines in trespass cases*

Character of trespass	Cases	Damages	Fines
Grazing	27	$5,587.58	
Fire	454	24,356.70	$3,118.57
Timber	245	13,417.52	1,011.95
Property	57	884.96	857.83
Occupancy	15	76.46	
Miscellaneous	6		597.50
Total	804	44,323.22	5,585.85

CASES OF INTEREST

In the case of *Red Canyon Sheep Co. et al.* v. *Secretary of Interior and Commissioner of the General Land Office*, the Red Canyon Sheep Co. protested the approval of an exchange of lands by the Government and C. M. Harvey. Harvey had offered to convey certain lands within the Lincoln National Forest and, in exchange therefor, he had selected lands outside the forest. The latter property was within the boundaries of grazing district No. 4, established under the Taylor Grazing Act. In its decision, the Court of Appeals for the District of Columbia held that, in view of the grazing withdrawal and the grazing rights established by livestock owners, the lands within the grazing district were not subject to selection by Harvey. The decree enjoined the Secretary of Interior from consummating the exchange "in the manner now proposed."

Efforts are still being made by the Office to effect the exchange in a legal manner.

In the case of *United States* v. *J. D. Chalk et al.*, now pending in the United States District Court for the Eastern District of North Carolina, the Government is seeking an order to restrain State officials from interfering with the management of the Pisgah National Forest and the Pisgah National Game Reserve. The defendants threaten to enforce the State game laws against persons who hunt deer on, and ship deer and their carcasses from, the forest and reserve. It is the contention of the Government that, in view of two laws enacted by the State Legislature of North Carolina, the United States is vested with the exclusive power to control game and fish in the national forests within the State. By the first law, the Government was granted the right to acquire lands for forest purposes and to provide such laws, both of a criminal and civil nature, as might be necessary to control the lands. The second law expressly authorized the Government to make rules and regulations for the control of game and fish in the national forests.

PACKERS AND STOCKYARDS ACT

Eight operators, engaged in the live-poultry business, were convicted of operating without licenses in violation of the act. Fines aggregating $1,025 were imposed. In another case of this nature, the defendant entered a plea of not guilty and expressed an intention to test the constitutionality of the act.

The following tabulation contains a summary of the formal administrative proceedings under the Packers and Stockyards Act:

	Number
Procedings pending July 1, 1938	61
Proceedings instituted:	
Trade practice violations and financial conditions	22
Complaints for reparation	16
Insolvency	16
Failure to maintain bonds	5
Rates	3
Applications for poultry licenses	16
Total	78
Proceedings reopened (involved trade practices)	2

Proceedings closed and types of orders issued:	Number
Cease-and-desist and suspension orders	20
Reparation orders	8
Suspension orders	2
Orders prescribing rates and charges	5
Orders granting licenses	23
Orders denying licenses	7
Orders revoking licenses	11
Orders of dismissal	26
Miscellaneous orders	2
Total	104
Proceedings pending June 30	37

In addition to the orders included in the foregoing tabulation, orders previously issued in two rate proceedings were modified, and orders previously issued in two trade-practice proceedings were revoked.

CASES OF INTEREST

Following the decision of the Supreme Court in the case of *Morgan* v. *United States* (304 U. S. 1 (1938)), the Secretary reopened the proceeding to determine the reasonableness of rates charged by the market agencies operating at the Kansas City Stockyards. Temporary findings of fact and a temporary order were served upon the agencies. Upon motion of the respondents, the Secretary directed an examiner to take evidence relative to any change in conditions during the period from the time of the closing of the record in November 1932 to November 1, 1937. (The Secretary's original order was modified on the latter date, and there was no issue concerning the reasonableness of rates after that time.) After the examiner's report was issued following the taking of the evidence, there was an oral argument before the Secretary. The Secretary's new order was promulgated on June 20, 1939. It prescribed reasonable rates for the period from July 23, 1933, the effective date of the original order, to November 1, 1937.

Soon after the opinion in the *Morgan* case was rendered by the Supreme Court on April 25, 1938, the Secretary filed a motion in the district court to stay proceedings with respect to the distribution of approximately $600,000 impounded by the agencies. This sum represented the difference between the rates prescribed in the original order and the rates actually charged. However, the district court granted a counter motion of the agencies to have the money distributed among them. On appeal, the Supreme Court reversed this decision and directed the district court to retain the funds pending issuance of the Secretary's order. The Supreme Court stated that the lower court, with the full record of the Secretary's proceedings before it, then would have sufficient basis upon which to base an order of distribution.

PERISHABLE AGRICULTURAL COMMODITIES ACT

In proceedings under the Perishable Agricultural Commodities Act, the Secretary issued 242 reparation orders, revoked 13 and suspended 12 licenses, and ordered dismissal of 61 complaints. The total reparations awarded amounted to $101,759.36.

Thirteen cases were referred to the Department of Justice for the institution of suits to recover penalties for operating without licenses in violation of the act. Penalties were assessed in these cases in amounts varying from $30 to $2,550; the total was $6,879.66.

The final decisions rendered by the Secretary during the year, with their respective grounds and numbers, were as follows: Rejection by the buyer without reasonable cause, 70; failure to deliver without reasonable cause, 42; failure truly and correctly to account, 204; failure to keep adequate records and accounts, 2; false and misleading statements, 4; and unfitness to receive license, 3.

Twenty-three cases were appealed to the Federal Courts. Decisions in 4 of these cases were rendered during the year. The Secretary's orders were affirmed in 2 cases, judgment was rendered for the appellant in 1 case, and 1 case was dismissed.

CASES OF INTEREST

In the case of *W. A. White Brokerage Co.* v. *Edward A. Cooperman et al.*, the Fourth Judicial District Court of Minnesota had occasion to give judicial interpretation to certain procedural provisions of the Perishable Agricultural Commodities Act.

Prior to instituting suit in the Minnesota court, the White Brokerage Co. had filed a complaint with the Secretary. It was alleged in this complaint that the respondent Cooperman had failed to account truly and correctly with respect to the price of a load of peaches purchased from the complainant. After notice and hearing, the complaint was dismissed as to Cooperman on the ground that the peaches had not met contract specifications.

The defendants in the Minnesota case, which involved the same issues decided by the Secretary, pleaded res adjudicata. In sustaining the plea, the court held that the issues could be reviewed judicially only pursuant to the appellate procedure established by section 7 (c) of the act.

During the year, the Secretary issued an order awarding reparation against H. Rouw Co. and in favor of Frank J. Crivella. Since the amount involved was less than $500, the case was handled, as authorized by the act, without an oral hearing. The respondent appealed to the United States District Court for the Western District of Arkansas. The act provides that an appeal from an order issued by the Secretary shall be taken to the court in the district where the hearing was held. In view of the fact that no hearing had been held in the district, the court concluded that it had no jurisdiction over the case. An appeal from this decision was pending in the United States Circuit Court of Appeals for the Eighth Circuit at the close of the year.

COMMODITY EXCHANGE ACT

Three cases involving alleged violations of the Commodity Exchange Act were referred to the Department of Justice for prosecution. In two of the cases, forms of complaint were prepared in this Office. The defendant pleaded guilty in one case previously submitted for prosecution, and the court imposed a fine of $25. In two other cases, the parties were prosecuted under State and Federal statutes prescribing greater penalties, and the complaints under the Commodity Exchange Act were not prosecuted.

Representatives of the Office conferred on numerous occasions with the Departments of Commerce and Justice in connection with matters within the jurisdiction of the Commodity Exchange Commission. Assistance was supplied in the preparation of orders fixing limitations on speculative trading in grain futures.

Complaints and notices of hearing in six administrative proceedings were prepared. Final orders were drafted in four of the proceedings. Two proceedings were pending at the close of the year.

CASES OF INTEREST

As reported last year, Cargill, Inc., filed a complaint with the Commodity Exchange Commission charging the Chicago Board of Trade with manipulation of grain prices. A referee for the hearing was appointed from this Office. However, on motion of the complainant, this appointment was rescinded, and a referee from the Department of Justice was designated. When the complainant completed presentation of its case, the respondent filed a motion to dismiss. At the close of the year, the referee had the respondent's motion under consideration. The record at that point consisted of more than 12,000 pages. In December 1938 a complaint involving the same situation was issued by the Secretary against Cargill, but the hearing was not held during the year.

In the case of *United States* v. *D. W. Kohler*, in the United States District Court for the Northern District of Illinois, the defendant was charged with violating section 4c (B) of the Commodity Exchange Act. It was alleged that the defendant had made offers in this country to enter into transactions, known as privileges, on the Winnipeg Grain Exchange. The defendant filed a demurrer, which was overruled. Subsequently, he entered a plea of guilty and the court imposed a fine of $25. Before the termination of this case, many persons had contended that the act was not applicable to such transactions.

The preferred status of commodity customers in bankruptcy cases, due to the segregation requirements of the act, was demonstrated during the year. In bankruptcy proceedings involving Burke & Co., Sioux Falls, S. Dak., whose trading

privileges on contract markets had been denied by the Secretary for violations of the act, commodity customers received about 46 percent of their claims. Awards of less than 30 percent were made on claims of common creditors.

TOBACCO INSPECTION ACT

Mention was made in last year's report of the decision of the United States Circuit Court of Appeals for the Fourth Circuit upholding the constitutionality of the Tobacco Inspection Act of 1935. On January 30, 1939, the Supreme Court, in the case of *Currin et al.* v. *Wallace*, sustained the decision of the circuit court of appeals.

UNITED STATES WAREHOUSE ACT

During the year, two criminal cases, involving violations of the act, were successfully terminated.

PRODUCE AGENCY ACT

There were nine cases pending from the previous year. Two new cases were referred to the Department of Justice. In one case, the defendant was given a suspended jail sentence and was placed on probation pending payment of the amount due to the consignor. One case was dismissed. Nine cases were pending at the close of the year.

FEDERAL SEED ACT

At the beginning of the year, there were two criminal cases pending. One seizure case was reported to the Department of Justice. Each of the cases was dismissed.

UNITED STATES GRAIN STANDARDS ACT

One administrative proceeding under the act was concluded during the year.

WILDLIFE CONSERVATION

Table 4 summarizes cases handled under the Migratory Bird Treaty Act (40 Stat. 755), the Migratory Bird Conservation Act (45 Stat. 1222), the Bird and Animal Reservation Trespass Act (sec. 84 of the Penal Code), the Lacey Act (31 Stat. 187; 49 Stat. 380), the Migratory Bird Hunting Stamp Act (48 Stat. 451), and the Upper Mississippi River Wildlife and Fish Refuge Act (43 Stat. 650).

TABLE 4.—*Wildlife conservation cases*

Law	Cases pending July 1, 1938	Cases reported	Cases pending June 30, 1939	Cases terminated	Cases in which fines were assessed	Amount of fines
	Number	*Number*	*Number*	*Number*	*Number*	*Dollars*
40 Stat. 755	263	861	272	852	557	[1] 18,430.50
45 Stat. 1222	4	30	16	18	3	215.00
Sec. 84 of the Penal Code	21	11	5	27	16	201.00
31 Stat. 187; 49 Stat. 380	4	18	2	20	17	1,460.00
48 Stat. 451	[2] 46	88	30	104	80	590.00
43 Stat. 650	8	26	20	14	6	210.00

[1] In addition, $526 in fines were suspended.
[2] Additional cases disclosed after preparation of last year's report.

The following tabulation shows the disposition of cases terminated:

40 Stat. 755:	*Cases*
Closed with convictions	648
Dismissed	82
Closed without prosecution	66
Defendants adjudged not guilty	23
Nolle prossed	20
No true bills returned	10
Closed by death	3
Total	852
Total of jail sentences	2,585 days.
Total of suspended jail sentences	1,786 days.
Total of probationary periods imposed	92 years, 6 months.

45 Stat. 1222:	Cases
Closed with convictions	15
Closed without prosecution	2
Dismissed	1
Total	18
Total of jail sentences	300 days.
Total of probationary periods imposed	2 years, 6 months, 3 days.

Sec. 84 of the Penal Code:	Cases
Closed with convictions	22
Dismissed	4
Defendant adjudged not guilty	1
Total	27
Total of probationery periods imposed	8 years.

31 Stat. 187; 49 Stat. 380:	Cases
Closed with convictions	19
Dismissed	1
Total	20
Total of jail sentences	90 days
Total of probationary periods imposed	3 years

48 Stat. 451:	Cases
Closed with convictions	87
Dismissed	12
Closed without prosecution	1
Nolle prossed	1
Defendant adjudged not guilty	1
No true bills returned	2
Total	104
Total of jail sentences	90 days
Total of suspended jail sentences	90 days
Total of probationary periods imposed	1 year

43 Stat. 650:	Cases
Closed with convictions	11
Dismissed	2
Closed without prosecution	1
Total	14
Total of suspended jail sentences	3 years, 4 months.
Total of probationary periods imposed	6 years.

CASES OF INTEREST

In the case of *United States* v. *Hubert K. Reese*, in the United States District Court for the Western District of Tennessee, the defendant was charged with violating the Migratory Bird Treaty Act and the regulations promulgated thereunder. It was alleged that the defendant had hunted and killed mourning doves which had been lured to the hunting grounds by the use of wheat. The defendant filed a demurrer and a motion to quash on the ground that he was not charged with knowledge of the baiting for the purpose of luring the doves to the hunting grounds. The court, in its decision overruling the demurrer and motion to quash, held that it is not necessary to allege in the information, or to prove at trial, that the defendant had knowledge of the unlawful baiting. This was the first case in which a court held that scienter is not a necessary allegation in an information or an essential element of proof at the trial.

Mention was made in the report of the preceding year of the case of *United States* v. *A. C. MacMillan et al.*, in the United States District Court for the District of Minnesota. During the year, the court enjoined the defendants from further destruction of ditches, dikes, dams, and other water-control structures on lands of the Government within the boundaries of the Mud Lake Migratory Waterfowl Refuge in Minnesota.

FARM SECURITY DIVISION

RURAL REHABILITATION PROGRAM

LOANS TO INDIVIDUALS

This program has been authorized by the several Emergency Relief Appropriation Acts. Loans to individuals made under the authority of the Emergency Relief Appropriation Acts prior to 1938 were usually made repayable over periods not greater than 5 years. Virtually all of such loans were secured by various security instruments, and legal assistance with respect to the servicing of such loans was provided by the Office. Such servicing involved the preparation of legal documents evidencing renewals and extensions, the release of security, and the obtaining of substitute security for such loans. The legal documents necessary to be executed in connection with the making of loans out of the funds appropriated by the Emergency Relief Appropriation Act of 1938 were prepared by the Office. Such instruments included subordination and nondisturbance agreements and other legal instruments necessary to give priority over existing liens on the property of the loan recipients to the security taken by the Government. The legal instruments prepared for use in making individual loans included promissory notes, chattel and real-estate mortgages for use in the various States, crop liens, assignments of contracts to sell agricultural products, and similar security instruments. In connection with the individual loan program, over 540 forms were prepared or reviewed in the regional branches and the Washington Office. General memorandums embodying legal advice for the making, servicing, or collection of loans prepared and issued by the Office numbered 2,804. Security instruments used in individual cases, which were either prepared, revised, or reviewed by the Office, numbered 9,734, and 10,056 legal memorandums were prepared and issued in connection with legal problems arising out of individual loan accounts.

LOANS TO COOPERATIVES

Under the rehabilitation program, loans were made to existing cooperatives and to individuals to obtain participation rights in such cooperative activites, as authorized by the Emergency Relief Appropriation Acts. Legal advice as to the servicing of such loans made prior to July 1, 1938, was provided by the Office and appropriate legal forms prepared. The legal instruments necessary to evidence loans made during the year and to evidence security taken therefor were prepared, and amendments to the cooperative articles and bylaws were prepared when necessary. Among the security instruments so prepared or reviewed by the Office were farm leases, assignments, chattel mortgages, real-property mortgages and deeds of trust, marketing agreements, assignments, and other security devices to meet the requirements of the laws of the several States. Articles of incorporation and bylaws were prepared for newly established cooperative associations to which loans were made. Such cooperative associations included marketing and purchasing groups, medical-care cooperatives, livestock-insurance cooperatives, and associations formed for the provision of livestock-breeding services to members. The legal instruments evidencing loans made to individuals to participate in existing cooperatives and the security instruments taken therefor were prepared, and also the legal forms used in evidencing loans made to individuals for the purchase of property for the use of the purchaser and other farm families residing in the area. The Office examined 109 loan applications from existing cooperatives; 1,569 applications of individuals to participate in such associations or group activities were reviewed; 161 partcipating-loan forms were prepared; and 182 sets of articles of incorporation and bylaws, or amendments thereto, were prepared. The Office reviewed more than 750 security instruments obtained by the Government as security for loans made to cooperative associations. Six hundred and fifty-two legal memorandums embodying legal advice on loans to particular cooperative or participating groups were prepared.

COLLECTIONS

The Office prepared the basic memorandums outlining the steps to be taken in collecting rehabilitation loans made under the authority of the Emergency Relief Appropriation Act. A procedure to be followed in each State in repossessing and foreclosing the security instruments held by the Government was prepared, together with all forms incident to the execution of such fore-

closure sales. In addition, the Office prescribed the procedure to be followed in individual cases when it was necessary to liquidate the security interests of the Government. When court action was necessary, the Office referred each case to the Department of Justice and supplied the appropriate United States Attorney with the necessary legal memorandums and briefs. The Office prepared the pleadings involved in such cases when requested to do so by the Department of Justice.

Basic procedure was prepared outlining the steps legally necessary to assert the Government's claims in all bankruptcy and probate matters. Proofs of claim and related legal instruments were prepared and filed in each case where a rehabilitation borrower became involved in bankruptcy proceedings, and in each case where it was necessary to assert the claim of the Government against the estate of a deceased borrower. Approximately 450 cases of bankruptcy and 1,650 cases involving claims against estates received individual attention.

Individual attention was afforded in 2,728 cases in which it was necessary to collect the accounts owing to the Government by foreclosure of security instruments. The Office referred 460 cases to the Department of Justice for the institution of legal proceedings to protect the interest of the Government in rehabilitation loans. The Office reviewed claims of third parties against property mortgaged to the Government in 688 cases and referred 244 of them to the Department of Justice. In addition, all cases involving violation of the criminal laws of the States were referred to the appropriate prosecuting officials, who were also supplied with necessary legal memorandums and other appropriate assistance.

RURAL REHABILITATION CORPORATIONS

All legal matters arising out of the transfer and management of the assets of the 41 State rural-rehabilitation corporations were handled by the Office. The legal instruments necessary to evidence amendments or supplements to 24 of the agreements, evidencing the transfer of said corporate assets, were prepared. All legal instruments required in effecting the dissolution of 2 of such State corporations were prepared, and a procedure for such dissolutions, meeting the requirements of the appropriate State laws, was designed and issued. The Office prepared 553 instruments evidencing the sale, leasing, or licensing of former corporation properties. Legal advice with respect to all claims made on behalf of, or against, the corporations were handled, and more than 700 legal memorandums dealing with problems arising out of the administration of the corporation trust fund assets were prepared. Several agreements of understanding were prepared between the Farm Security Administration, Works Progress Administration, and the Soil Conservation Service, relating to the cancelation of accounts for loans made by corporations, use of corporate lands by C. C. C. camps, etc.

FARM TENURE IMPROVEMENT

Incidental to the program of rural rehabilitation was the consideration of the tenure relations of the participants in that program and other tenant farmers. Considerable work was done by the Office in attempting to devise more or less standard lease forms which could be used under the laws of the various States and which would have the effect of improving the relations between agricultural landlords and their tenants. Eight such model lease forms were prepared, which covered both agricultural and livestock enterprises and which contained provision for compensating outgoing tenants for soil-conserving practices carried on by such tenants. Further improvement and refinement of such lease forms will continue to receive the constant attention of the Office. The lease forms were printed in large quantities by administrative officials and distributed among all the rehabilitation clients and were made available for all other persons and institutions interested in the improvement of agricultural landlord-tenant relations.

The regulation of the relationship between farm landlords and tenants is the function of the various States. The report of the President's Committee on Farm Tenancy suggested that the Federal Government assist the various States in perfecting their laws so as to make for more harmonious landlord-tenant relationships. Several of the States have set up commissions to study this question; in other States, the land-grant colleges have interested themselves in this problem. It has been the policy of the Department to render assistance with respect to the various studies of farm tenancy conducted in the respective

States. In this connection, the Office furnished advice of an extremely technical and comprehensive nature. In two States, complete studies were made of State landlord-tenant laws. Similar studies are in process with respect to other States. In still other States, legislation designed to perfect various aspects of the farm landlord-tenant relationship was prepared or reviewed. Such legislation was analyzed with respect to its operative meaning and with respect to its constitutionality.

FARM DEBT ADJUSTMENT PROGRAM

The Secretary is authorized to conduct a program to attempt the scaling down of excessive farm debts as a step preliminary to the rehabilitation of low-income farm families. Legal assistance with respect to this program was provided, which included the preparation of legal forms, such as composition agreements, subordination agreements, etc.

FARM TENANT PROGRAM

The legal work incident to the administration of title I of the Bankhead-Jones Farm Tenant Act (50 Stat. 522) was greatly enhanced owing to an increase in the appropriation.

The legal details of the loan-making procedure, as prepared by the Office during the proceding fiscal year, have, in general, proved satisfactory in operation. Hence, it was unnecessary to make any radical changes in the legal forms and procedures used in connection with the making of loans under this program. Numerous minor changes were made in order to perfect the procedure in minor respects.

As far as the Washington office is concerned, the major emphasis shifted from the legal aspects of loan making to the legal aspects of loan administration. Numerous questions were presented in the course of the administration of the loans which had previously been made, necessitating legal advice and the preparation of legal forms and procedures. In particular, it became necessary to perfect procedures that will permit orderly transfer of the borrower's interest in the land to another borrower. This question arises in cases where the borrower is unwilling or unable to proceed with his loan. The preparation of this procedure involved extensive investigations of the laws of the several States, as well as research into the power of the Secretary under the Bankhead-Jones Farm Tenant Act. The major outlines of this procedure had been perfected at the close of the fiscal year.

Similar problems arise when a borrower dies. A start was made on developing a legal procedure adequate to meet the needs of administration and protect the interest of the borrower's family.

Much consideration was given to the administration of the construction portion of loan proceeds. The extremely scattered and rural character of the construction activities necessitated the development of new legal forms and techniques. It was found that the forms and procedures used under the resettlement program were not, in all respects, adaptable to this program, though considerable use was made of the legal experience obtained in the course of the administration of the resettlement program.

In addition to more than 2,000 general legal memorandums and over 3,000 instances of advice on individual cases given to administrative officials by the regional and Washington offices, nearly 3,500 loan dockets were examined. This included the examination of options, appraisal reports, reports of the county committees, loan agreements, and requests for funds. The greater number of these involved the examination or revision of the options.

In connection with this program, 7,124 options were received. Of this number, 4,106 were approved, and 2,493 purchases were closed. Title insurance on 3,342 cases was ordered, and 2,879 preliminary binders and 2,418 title policies were received from title insurance companies and examined. On the basis of preliminary certificates, closing instructions on 3,458 cases were issued to county supervisors. As security for these loans, over 10,000 legal instruments were prepared, revised, or reviewed. Nearly 100 legal forms, including mortgages, leases, deeds, loan agreements, etc., were prepared or revised.

RESETTLEMENT PROGRAM

The Office continued to organize, at the resettlement community projects, cooperative associations to engage in the production and marketing of agricul-

tural products and in the retail distribution of farm supplies to clients. During the year 75 articles of incorporation, 68 sets of bylaws, and 105 sets of corporate minutes were prepared, and 43 articles of incorporation, 37 sets of bylaws, and 190 sets of corporate minutes were revised or reviewed. In connection with loans made to these cooperative associations and instruments of security and collateral for repayment of such loans, the Office prepared or reviewed 679 conditional sales contracts, 37 chattel mortgages, 12 real estate mortgages, 21 bills of sale, 130 bonds and insurance policies, 39 deeds, 28 budgets, 377 loan dockets and loan agreements, and 935 miscellaneous forms. The Office assisted the Department of Justice in 29 eviction suits, 5 specific-performance suits, and 19 cases of irregularities on several resettlement projects.

In connection with industrial enterprises at resettlement projects, the Office handled all of the legal work relating to the financing, establishment, and operation of five hosiery mills, two garment factories, one tractor-assembly plant, and one wood-dimension-stock plant. This involved the organization of several business corporations and the preparation of leases, management contracts, stock-purchase options, and various types of security instruments. After approval of the propoal for the establishment of the five hosiery mills, the Comptroller General took exception to the expenditure of appropriated funds for their financing. In this connection, an exhaustive legal opinion to the Secretary was prepared by the Office. On the basis of a submission prepared by the Office, the Attorney General sustained the legality of the action of the Secretary in authorizing the financing and establishing of these mills (39 Ops. Atty. Gen., Op. No. 69). Subsequently, on a resubmission of the matter to the Comptroller General, the legality of the Secretary's action was sustained.

This Office performed the legal work involved in establishing, at approximately 23 different localities, projects for the resettlement of groups of rural-rehabilitation clients. This involved the organization of homestead associations, the preparation of leases of land from private owners to such associations, and a review of the owners' titles to the land.

Pursuant to the provisions of the Bankhead-Black Act (49 Stat. 2035), the Office (in addition to legal advice given during the period of negotiations) examined 2,399 requests submitted by local governmental subdivisions for payments in lieu of taxes and prepared the same number of agreements. Of these agreements, 1,217 were executed and findings of fact in support thereof were drafted.

There were drafted or revised in the Washington and regional offices 257 easement agreements to utility companies and conveyances to local public bodies for parks, playgrounds, roads, and school purposes.

The construction work in connection with the resettlement community projects necessitated reviewing 1,028 construction contracts and performance and payment bonds and the approval for payment of 65 final forms. The Office also prepared, revised, or reviewed 1,262 lease-and-purchase contracts and 3,352 other leases and tenure forms.

FISCAL DIVISION

PATENTS

As in the past, an important phase of Office activity was in connection with the procurement of patents on inventions of Department employees. Two hundred and forty-four applications for letters patent were prosecuted in the Patent Office. Ninety-eight applications were terminated as follows: 61 were granted, 22 were abandoned, and 15 were rejected. Thus, 146 applications remained pending at the close of the year. Two of the pending applications are involved in interference proceedings.

Transfer of title to three patents, which were obtained through other channels, was effected. The first of these patents, No. 2,062,554, entitled "Hog-Tongue Guard," was dedicated to the public by John A. Carlsen, an employee of the Department. The other two patents, Nos. 1,606,015 and 1,446,113, designated, respectively, "Methods of Making Plant Foods" and "Plant Propagation Cells and Containers," were dedicated to the people of the United States by Mrs. Maude A. Blackwell.

A number of licenses, covering the use of various patents obtained through this Office, were prepared or examined.

Two patents obtained during the year are indicative of the value of this work. Great savings to producers and shippers of cream will result from Patent No. 2,142,864, entitled "Method for Storing, Transporting, and Restoring Sweet

Cream." Under the method prescribed in that patent, sweet cream can be stored for as long as 2 weeks and can be transported without refrigeration or freezing. Patent No. 2,130,783 presents new horizons for producers of vegetable fibrous materials. By the process outlined in this patent, the materials, e. g., sawdust or bagasse, can be treated in a manner which renders the lignocellulose complex suitable for molding, with or without a plasticizer.

BIDS, CONTRACTS, LEASES, AND BONDS

In addition to the contracts and leases listed in table 2, 596 renewals and 91 terminations of leases and contracts were prepared or examined, and 1,392 cooperative agreements for experimental work were also reviewed.

Bids in an amount in excess of $19,000,000 were awarded for construction work, for supplies, and for office, warehouse, and garage space. After award of these bids, many contracts, leases, and related instruments were prepared. Among the important contracts awarded were those for the construction of regional laboratories at Peoria, Ill., Philadelphia, Pa., New Orleans, La., and Albany, Calif., at an aggregate cost of $3,387,000. Important, too, was an outlay of $839,510.44, under 18 contracts and 20 extension agreements, for aerial survey work.

The Office prepared or examined 5,160 bonds covering Department employees, 11 bonds for agent cashiers, 8 bonds for curative agents, 4 bonds for market administrators, and 7 stipulation-and-consent agreements relating to disbursing agents' bonds. In addition, there were examined for sufficiency of execution 197 contract-performance bonds, 32 payment bonds, 40 bid bonds, 36 annual bid bonds, 3 bonds of indemnity for irregularities in the handling of participation trust certificates, 221 bonds and riders covering treasurers of county agricultural conservation associations, and 4 bonds covering advances of funds to employees for miscellaneous expenses.

Where the records of the Treasury Department disclosed that agents of surety companies had executed bonds without authority, ratifications of the agents' acts were obtained from the home offices of the companies.

Under the grant-in-aid program of the Agricultural Adjustment Administration, over $3,900,000 was expended for fertilizers to be distributed to farmers in lieu of cash benefits. In each State in which this program was inaugurated, a different type of contract was required, and a source-of-supply contract was designed to meet this exigency.

CLAIMS AGAINST THE GOVERNMENT

Many claims based on the negligence of departmental employees were submitted to this Office for legal review. Such claims were submitted under two acts, the so-called Small Claims Act of December 28, 1922 (42 Stat. 1066), and section 16 of the so-called Civilian Conservation Corps Act of June 28, 1937 (50 Stat. 319).

Table 5 summarizes the claims handled during the year under the above acts, also the total amounts of the claims.

TABLE 5.—*Claims under the so-called Small Claims and Civilian Conservation Corps Acts*

Claims	Number	Amount involved
Original:		
Pending at beginning of fiscal year	195	$41,516.08
Filed (315 claims under 42 Stat. 1066; 471 claims under 50 Stat. 319)	786	250,405.54
Claims disallowed	361	194,741.65
Claims allowed in full amount claimed	249	9,032.62
Claims recommended for partial payment (representing claimed amounts aggregating $43,044.28)	152	11,601.52
Cases dropped	5	----------
Cases pending at close of year	214	----------
Appeals from prior decisions:		
Pending at beginning of fiscal year	25	9,876.32
Filed	76	12,344.39
Cases reexamined and adjustements made	96	2,323.05
Pending at close of fiscal year	5	----------

The majority of the claims, as in past years, arose out of automobile collisions. The remaining claims involved a variety of situations. Opinions were rendered only after complete data had been examined and the applicable State laws had been considered.

The Office also handled 11 claims under the act of January 31, 1931 (46 Stat. 1052), and 9 claims filed pursuant to the act of May 27, 1930 (46 Stat. 387).

CLAIMS AGAINST PRIVATE PARTIES

As a result of motor-vehicle collisions involving damage to Department property, 205 cases were referred to this Office for appropriate legal action. Demand for reimbursement was made in those cases in which the evidence indicated negligence upon the part of the operators of the privately owned vehicles and a lack of negligence on the part of Department drivers. Where settlements could not be effected, the cases were submitted to the Department of Justice for appropriate action. Forty-two of the claims were still pending on June 30.

Bureaus of the Department also referred to the Office for amicable settlement 21 additional claims of this character. Two of these claims were pending at the close of the year.

WORK UNDER THE FEDERAL HIGHWAY ACT AND SUPPLEMENTS THERETO

The several State highway departments submitted 1,506 original and 441 revised project statements relating to Federal-aid road projects. These were first examined for the purpose of determining their eligibility under the law, and those found to be eligible were recommended for the approval of the Secretary. Review of original and revised project statements for 27 Federal-lands highway projects and 2 flood-relief projects was similarly completed.

Before submission to the Secretary, or his authorized representatives, for execution, 4,852 original project agreements and related documents were reviewed as to form and as to the sufficiency of the execution by State highway departments. Drafts of 742 modified project agreements and attendant instruments were also examined. The project and modified project agreements actually executed involved the improvement of 14,170.8 miles of road at an estimated expenditure of $337,136,555.

Also considered and recommended for execution by the Secretary, or his authorized representatives, were seven modified project agreements, together with supplementary papers, for National Recovery Work Relief projects. These projects involved work estimated to cost $146,565.

In connection with flood-relief projects, 7 modified and 71 original project agreements, involving work on 80.6 miles of road at an estimated cost of $5,139,626, were examined and recommended to the Secretary for execution. There were handled also 38 original and 3 modified project agreements for Federal-lands highway projects, which involved the estimated expenditure of $2,074,574 for construction work on 242.6 miles of road.

In all, the Office considered 7,696 separate sets of project documents, which provided for improvements on 14,494.0 miles of road at an estimated cost of $344,497,320.

One hundred and fifty-three cooperative agreements for the construction of roads wholly or partly within national forests were also handled, and 89 original contracts for this type of improvement were consummated.

PERSONNEL MATTERS

There were 36 cases pertaining to irregular administrative practices and general personnel misconduct. In such situations, the Office determined whether criminal acts were involved and, if so, referred the cases to the Attorney General for prosecution. Where money or property discrepancies existed, the cases were submitted to the General Accounting Office, or demands for restitution were made upon the employees and surety companies involved.

Requests were received to defend numerous employees of the Department who had been arrested for traffic violations while in the performance of their duties. In cases in which the defenses were deemed legitimate, Office attorneys were assigned to represent the employees in hearings in the Office of the Corporation Counsel and at trials in the traffic court. When official duties involved employees in civil actions, legal assistance and advice were likewise rendered. Release of employees from serving as witnesses or jurors was obtained in a number of instances where service in such capacities would have interfered with their official work.

BANKRUPTCY MATTERS

Periodically, the Treasury Department submitted lists of corporations which had filed petitions for reorganization under section 77 (b) of the Bankruptcy Act. After ascertaining from the bureaus and agencies of the Department whether any of the corporations were indebted to, or were creditors of, the Department, the Office filed reports with the Treasury Department. Where individuals indebted to the Department filed petitions in bankruptcy, appropriate action was taken to protect the Department's interests.

SUPPLEMENT TO THE LAWS APPLICABLE TO THE DEPARTMENT OF AGRICULTURE

The Office largely completed compiling for publication a supplement to the Laws Applicable to the Department of Agriculture (1935), together with a complete index to the first volume and the supplement. When issued, this publication will include all statutes affecting the Department enacted in the second session of the Seventy-Fourth Congress, in the Seventy-Fifth Congress, and in the first session of the Seventy-Sixth Congress. It will also embody Reorganization Plans I and II and all legislation relating to the Farm Credit Administration, the Commodity Credit Corporation, the Rural Electrification Administration, and their auxiliary units.

HEALTH AND QUARANTINE DIVISION

FOOD AND DRUGS ACT AND FEDERAL FOOD, DRUG, AND COSMETIC ACT

The Federal Food, Drug, and Cosmetic Act, approved by the President on June 25, 1938, in terms supplants all provisions of the Federal Food and Drugs Act of 1906, as amended, except the so-called sea-food amendment. Many sections of the new law became effective upon Presidential approval, and the remaining sections were to take effect 1 year thereafter. However, the so-called Lea amendment, which was signed by the President on June 23, 1939, postponed the effective date of several provisions of the new law until January 1, 1940. The Lea amendment also authorized the Secretary to postpone the effective date of certain labeling provisions until July 1, 1940.

Section 701 of the Federal Food, Drug, and Cosmetic Act provides for the promulgation of regulations fixing definitions and standards of identity, standards of quality, and standards of fill of container for foods, establishing tolerances for unavoidable poisonous ingredients in foods, requiring the labeling of foods offered for special dietary purposes, governing emergency control of food manufacture and packing, requiring the labeling of certain types of drugs, providing for the certification of coal-tar colors, and governing the testing of various drugs for strength, quality, and purity, etc.

In conformity with section 701, seven public hearings, covering a total of 37 days, were held for the reception of evidence upon the basis of which the Secretary might establish definitions and standards of identity, quality, and fill of container for a number of foods. There was also a hearing for the receipt of evidence upon which to base regulations providing for the listing of certain types of coal-tar colors, for the certification of batches of the colors, and for the payment of fees for such certification.

CASES OF INTEREST

The case of *United States of America* v. *24 Packages, More or Less, of Z-G Herbs No. 17, Double Strength; 19 Packages, More or Less, of Z–G Herbs No. 17*, a civil action in the United States District Court for the Eastern District of Michigan, involved the alleged misbranding of drugs. In the libel, it was alleged that the container labels bore false and fraudulent therapeutic claims.

The same shipments and transactions were at issue in cases previously adjudicated, and a plea of res adjudicata was entered by the claimant. He introduced records of criminal cases decided by the United States District Court for the Northern District of Illinois, wherein the court held that the claims on the labels were not therapeutic in nature. He also introduced the record of a seizure case in the United States District Court for the Southern District of New York, in which the court held that the Illinois decision barred the seizure action.

Claimant's plea was overruled, and the case was tried on its merits. At the conclusion of the evidence, the court sustained the charges of the Government. The claimant signified his intention to appeal.

The case of *United States* v. *Certain Quantities of "Roux Lash and Brow Tint,"* the first contested action under the Federal Food, Drug, and Cosmetic Act, is of particular interest. In libels filed in the United States District Court for the District of New Jersey and in the United States District Court for the Northern District of Illinois, the Government alleged that certain quantities of a cosmetic, Roux Lash and Brow Tint, were adulterated. Thereafter, seizures of the product were effected. Roux Laboratories, Inc., appeared as claimant in both instances. The actions were transferred to the United States District Court for the Eastern District of New York and were consolidated for trial. The claimant denied the Government's allegation that the product "bears and contains poisonous and deleterious substances, namely, parogallel, ammoniacal silver sulfate and silver nitrate, which may render it injurious to users under the conditions of use prescribed in the labeling and under conditions of use as are customary and usual."

In the ensuing trial, expert testimony was introduced by the Government to prove that certain injuries sustained by witnesses resulted from the use of the cosmetic. To rebut this testimony, the claimant sought to prove that, due to the skilful blending of materials by its expert chemists, the preparation was harmless.

At the conclusion of the testimony, the court charged the jury, in part, substantially to the effect that the words "may render it injurious," as used in the act, required the Government to prove, with a reasonable degree of certainty, that the application of the cosmetic in the manner prescribed in the labeling would result in injury to the ordinary user; and that this burden would not be met by showing injury or the likelihood of injury to persons of unusual sensitiveness.

The jury were unable to agree, and a mistrial was declared. The case will be retried.

B. A. I. ORDERS AND RELATED MATTERS

Several orders pertaining to livestock were submitted for legal review. Among these orders were regulations governing (1) the recognition of breeds and books of record of purebred animals (B. A. I. Order 365), (2) the prevention of the spread of splenetic fever (B. A. I. Order 369), (3) the inspection and quarantine of livestock imported from, or exported to, Mexico (B. A. I. Order 368), (4) the prevention of the introduction of rinderpest and foot-and-mouth disease into the United States (B. A. I. Order 370), and (5) the appraisal of, and payment for, cattle condemned and destroyed in the eradication of tuberculosis and Bang's disease (B. A. I. Order 367 and B. A. I. Order 367, Amendment 1).

The Office also reviewed 11 bonds to insure the proper handling of restricted import animal byproducts.

PLANT QUARANTINES AND REGULATIONS

In connection with plant quarantines and regulations, legal advice and assistance were rendered in the following matters: Issuance of white-fringed beetle quarantine with regulations (No. 72); advancement of the 1938 termination date on fruit and vegetable restrictions established under the Japanese beetle quarantine; revision of gypsy-moth quarantine and regulations (No. 45); revision of Japanese beetle quarantine regulations (No. 48); revision of pink bollworm quarantine and regulations (No. 52); amendment of Japanese beetle quarantine regulations (No. 48, Amendment 1); amendment of pink bollworm quarantine regulations (No. 52, Amendment 5); and amendment of nursery stock, plant, and seed quarantine (No. 37, Amendment 3).

FILLED MILK ACT

As reported last year, the Supreme Court, in the case of *United States* v. *Carolene Products Co.*, 304 U. S. 144 (1938), upheld the constitutionality of the Filled Milk Act. The court directed the United States District Court for the Southern District of Illinois to overrule the demurrer that had been filed in the case. After trial on the merits, the jury found the company guilty of shipping in interstate commerce certain quantities of a product, known as

Carolene or Milnut, in violation of the act. A fine of $1,000 was imposed. On appeal, the United States Circuit Court of Appeals for the Seventh Circuit affirmed the verdict.

On May 9, 1938, the Department issued a statement to the effect that legal proceedings would be instituted against any person who shipped a product in interstate commerce in violation of the Filled Milk Act. Immediately after the statement was released, the Carolene Products Co. commenced an action in the United States District Court for the District of Columbia to enjoin the Secretary of Agriculture and the Attorney General from prosecuting the company, or from otherwise attempting to enforce the act against it, on account of the company's interstate dealings in a new product, known as The New Vitamin A Carolene or The New Vitamin A Milnut. Since the defendants had taken no steps toward prosecuting the plaintiff, the case was dismissed.

In an indictment returned to the United States District Court for the Northern District of Indiana on January 11, 1939, the same company was charged with violating the act by shipping quantities of the new product in interstate commerce.

The company then filed a bill of complaint in the United States District Court for the District of Columbia to enjoin the Secretary of Agriculture and the Attorney General from prosecuting the company, and from instituting criminal proceedings against it, for and on account of interstate shipments of the new product. In its bill of complaint, the company alleged that the new preparation was a mixture of pure, sweet, refined cocoanut oil, and pure, sweet, fresh skim milk, to which had been added and compounded vitamins A and D; that the compound had been evaporated to contain not less than 20 percent of skim-milk solids and not less than 6 percent of fat; that the product, as so constituted, had all the nutritional qualities of, and was an improvement on, evaporated milk. The plaintiff further alleged that the product was the result of a process developed after the passage of the act. For these reasons, the plaintiff contended that its product was so different from the products contemplated by Congress that the act was not applicable.

The plaintiff's application for a temporary injunction was denied on the ground that the plaintiff had failed to state sufficient facts for equitable relief. The court held that, even though the product was wholesome and nutritious, it came within the purview of the statute. Subsequently, at the trial on the merits, the district court dismissed the bill.

Tables 6 and 7 show the cases handled by the Division under the different acts during the year.

TABLE 6.—*Cases handled under Food and Drugs Act (34 Stat. 768), Federal Food, Drug, and Cosmetic Act (52 Stat. 1040), Insecticide Act (36 Stat. 331), and Federal Caustic Poison Act (44 Stat. 1406), fiscal year 1939*

CRIMINAL

Law	Cases pending July 1, 1938	Cases reported	Cases terminated	Cases pending June 30, 1939	Fines imposed	
					Number	Amount
Food and Drugs Act	173	[1] 209	243	139	210	$56,209.05
Federal Food, Drug, and Cosmetic Act	0	[2] 6	1	5	1	3,450.00
Insecticide Act	22	45	42	25	39	5,207.00
Federal Caustic Poison Act	1	5	1	5	1	50.00

CIVIL OR SEIZURE

Law	Cases pending July 1, 1938	Cases reported	Cases terminated	Cases pending June 30, 1939	Notices of judgment prepared and published
Food and Drugs Act	378	2,541	2,631	288	2,475
Federal Food, Drug, and Cosmetic Act	0	245	196	49	0
Insecticide Act	5	37	32	10	65
Federal Caustic Poison Act	0	6	5	1	5

[1] 1,297 violations involved.

[2] 55 violations involved.

The following tabulation shows the disposition of the criminal cases terminated:

Food and Drugs Act

	Number
Pleas of guilty and fines	154
Pleas of nolo contendere and fines	47
Nolle prosequi or dismissal	24
Verdicts of guilty and fines	9
Verdict of not guilty	1
Pleas of nolo contendere; placed on probation	4
Plea of nolo contendere; imposition of sentence suspended	1
Plea of guilty (fine combined with another case)	1
Pleas of guilty; placed on probation for 1 year	2
Total	243

Federal Food, Drug, and Cosmetic Act

Plea of nolo contendere and fine	1

Insecticide Act

Pleas of guilty and fines	32
Pleas of nolo contendere and fines	5
Verdicts of guilty and fines	2
Dismissal	1
Plea of nolo contendere; imposition of fine suspended	1
Plea of guilty; placed on probation for 1 year	1
Total	42

Federal Caustic Poison Act

Plea of guilty and fine	1

The following tabulation shows the disposition of the civil and seizure cases terminated:

Food and Drugs Act

	Number
Default decrees of destruction	1,830
Consent decrees of destruction	128
Consent decrees; goods released under bond for reconditioning	526
Dismissals (chiefly because no seizures were effected)	135
Judgments for claimant	3
Judgments for Government	3
Default decree of condemnation, forfeiture, and sale	1
Consent decrees; released for reconditioning	2
Decrees of condemnation and forfeiture; goods released on bond	3
Total	2,631

Federal Food, Drug, and Cosmetic Act

Default decrees of destruction	176
Consent decrees; goods released under bond for reconditioning	3
Dismissals (chiefly because no seizures of goods were effected)	17
Total	196

Insecticide Act

Default decrees of condemnation and destruction	28
Consent decrees; goods released under bond	3
Dismissal	1
Total	32

Federal Caustic Poison Act

Default decrees of destruction	5

TABLE 7.—*Cases handled under Naval Stores Act (42 Stat. 1435), Meat Inspection Act (34 Stat. 1260), and Filled Milk Act (42 Stat. 1486), acts relating to the interstate movement of livestock from quarantine districts or prohibiting interstate movement of diseased livestock (23 Stat. 31, 26 Stat. 414, 32 Stat. 791, and 33 Stat. 1264), the 28-hour law (34 Stat. 607), and the Plant Quarantine Act (37 Stat. 315), fiscal year 1939*

Law	Cases pending July 1, 1938	Cases reported	Cases terminated	Cases pending June 30, 1939	Fines (or penalties) assessed	
					Number	Amount
Naval Stores Act	0	1	0	1	0	
Meat Inspection Act	25	42	42	25	35	$1,785
Filled Milk Act	0	[1] 2	0	2	0	
23 Stat. 31	4	3	4	3	1	100
26 Stat. 414	0	0	0	0	0	
32 Stat. 791	13	8	11	10	7	1,300
33 Stat. 1264	0	0	0	0	0	
The 28-hour law	236	131	155	212	137	14,200
Plant Quarantine Act	[2] 3	0	0	3	0	

[1] Involving 9 violations.
[2] Additional cases disclosed after preparation of last year's report.

The following tabulation shows the disposition of the cases terminated:

Meat Inspection Act

	Number
Verdict of guilty and fine	1
Pleas of guilty and fines	27
Pleas of nolo contendere and fines	7
Dismissals	7
Total	42

23 Stat. 31

Fine	1
Dismissals	3
Total	4

32 Stat. 791

Fines	7
Expiration of a period of 18 months during which defendant was on probation without sentence	1
Dismissals	3
Total	11

The 28-Hour Law

Penalties recovered	137
Judgment for costs only	1
Dismissals	12
Judgments for the defendants	5
Total	155

LAND POLICY DIVISION

SOIL CONSERVATION

The year was notable for the continued expansion of the soil conservation districts program. With the enactment of soil conservation districts laws during 1939 in Alabama, Idaho, Iowa, Montana, Oregon, Tennessee, Texas, Vermont, Washington, and West Virginia, 36 States now have legislation embodying substantially the provisions of the standard law prepared in this Office 3 years ago.

Similar bills were introduced in Arizona, Delaware, Massachusetts, and Missouri, but the several legislatures failed to complete consideration of the proposed legislation. As was the case last year, the Governor of New York vetoed an enactment which departed considerably from the recommendations of the Department. Connecticut, Kentucky, Maine, New Hampshire, and Rhode Island are the only States in which bills dealing with this subject have not been introduced.

Soil conservation districts laws previously enacted were amended in California, Colorado, Florida, Illinois, New Mexico, North Carolina, and North Dakota. The California Legislature also validated all proceedings taken pursuant to the original law. Proposed amendments were defeated in Kansas and Nebraska, and amendatory legislation is still under consideration by the Wisconsin Legislature. Attempts to repeal existing soil conservation districts laws failed in Colorado, Kansas, Nebraska, New Mexico, North Dakota, and South Dakota.

Attorneys of the Office were active in several phases of this legislative program. Studies indicating necessary changes in the standard act to meet the constitutional and organizational requirements of the several States were completed. All but five of the existing districts laws have been analyzed to determine the necessity of future amendments. A number of conferences were held with State officials to explain provisions of the standard act and to help draft bills suitable for the States concerned.

Of crucial importance to the success of soil conservation projects is the proper organization and operation of the districts, and emphasis is being shifted to this portion of the program. A total of 161 districts, located in 24 States and embracing 88,436,148 acres of land, had been organized by June 15, 1939, and 207 additional districts were in the process of organization. Model rules and regulations governing the conduct of hearings, referendums, and elections, together with 47 different forms adequate to carry the organization of districts through the stage of the first meeting of the board of supervisors, were prepared and submitted to the State committees for consideration. Pending the culmination of efforts to supply all local legal services through the States' attorneys general, a number of opinions were written for the Soil Conservation Service on operative problems confronting State and district officials under the different State laws.

The Office participated in the drafting of basic regulations and detailed procedures for extending cooperative assistance to soil conservation districts, and reviewed 113 memorandums of understanding to be entered into by the Soil Conservation Service with districts located in 23 States. In connection with the correlation and integration of the soil conservation districts activities with other Federal operations, attorneys of the Office formulated a number of procedures and some proposed amendatory legislation.

LAND UTILITIZATION

With the close of the fiscal year, the first stage of one of the greatest plans of the Government to foster better land usage was completed. Beginning under the National Industrial Recovery Act and the Emergency Relief Appropriation Act of 1935, over 9,000,000 acres of land, costing about $46,000,000, were purchased and developed in furtherance of the undertaking, and the work is now being carried forward under title III of the Bankhead-Jones Farm Tenant Act.

Each phase of the program, viz, land acquisition, land development, and land management, gave rise to multitudinous legal questions. Attorneys of the Office handled problems pertaining to the sale, exchange, conveyance, reconveyance, and dedication of land; the granting of rights-of-way, concessions, licenses, and use permits; the ownership of accreted lands; the construction of dams within the limits of drainage districts established pursuant to State laws; the sale of timber, rock, and gravel; the exploitation of minerals; the regulation of hunting and fishing; the establishment of State game refuges; the improvement of highways furnishing access to projects; the purchase of membership in an electric cooperative to secure power at reduced rates; construction contracts; damage claims arising out of construction activities; and other varied subjects. Rules and regulations governing the use and occupancy of project lands, together with instructions for their enforcement, were prepared, and the Office submitted a number of trespass cases involving violations thereof to the Department of Justice for prosecution. As an adjunct to land acquisition activities, an analysis of departmental procedures in the acquisition of title to real property is nearing

completion and will serve as a basis for suggesting means of expediting and reducing the cost of title clearings.

Questions of primary importance resulted from the Federal-State relationship on property held by the Government. The Office was confronted with inquiries concerning the power of a State to sell lands on which taxes were not paid before acquisition by the Government, the liability of the United States for the payment of principal and interest on bonds issued by local public taxing units, the applicability of State regulatory laws, and other jurisdictional questions. A study of the problem of compensating States and their political subdivisions for loss of taxes on lands acquired by the Government was completed, and legislation embodying the Department's recommendations on the subject was drafted.

Before the execution of instruments transferring the administration of 631,000 acres of land in 22 project areas to various State and local agencies, the Office determined the authority of the agencies to comply with the provisions of the documents and where necessary prepared proposed State enabling bills. A number of executive and administrative orders, shifting some 3,210,000 acres of project property to several Government services, both within and without the Department, were drafted. The Office also formulated and reviewed memorandums of understanding relative to the coordination of the use of project and other federally owned lands.

Incident to the Department's conservation and land use programs, the Office assisted in the preparation of Secretary's memorandums, administrative orders and instructions, forms, and reports on proposed legislation.

WATER AND FLOOD CONTROL

With the establishment of the Water Facilities Board, the work of the Office with respect to water and attendant problems increased substantially. An attorney was detailed to attend all meetings of the Board and to accompany it on a field trip to organize the program, and all project dockets were reviewed either in Washington or in the regional offices.

A study of selected problems on the law of water rights in the West is rapidly nearing completion. The results of this research will serve as a basis for the determination of the adequacy of the State laws to promote sound water conservation and land use plans.

The Office also reviewed and prepared legislative reports on bills to authorize preliminary examinations and surveys on various watersheds not included in previous flood-control acts. With regard to proposed cooperative agreements with public agencies for flood control and to the establishment of a flood-control exhibit at the San Francisco Exposition, a number of opinions were prepared for administrative officials.

TIMBER SALVAGE IN THE NORTHEAST

Work incident to the timber-salvage operations in the North Atlantic States, ravished by the hurricane of September 21, 1938, was diversified. The contract under which the Federal Surplus Commodities Corporation borrowed funds from the Disaster Loan Corporation to begin salvage activities was prepared in the Office, as were also related notes, agreements, mortgages, and mortgage releases. Timber purchase, processing, and sales contract forms were formulated; and opinions were issued on intermediate financing arrangements, taxability of the timber by State units, and the applicability of other State laws.

COOPERATIVE FARM FORESTRY

During the year, cooperative farm-forestry activities were inaugurated by the Department, and all legal functions incident to the formulation and administration of this program were performed by the Office.

DIRECTIONAL MEASURES

Considerable legal assistance was afforded to administrative officials in connection with the Department's directional-measures work. In addition to issuing a number of memorandums on various parts of the undertaking, the Office aided in the preparation of suggested State legislation relating to the public acquisition of chronically delinquent tax lands, the management of public lands, the reorganization of counties, and rural zoning.

MARKET STABILIZATION DIVISION

MARKETING AGREEMENTS AND ORDERS

The work of the Office on marketing agreement and order programs under the Agricultural Marketing Agreement Act of 1937, as amended, progressed satisfactorily. Approximately 50 such programs, about half of which pertained to milk and its products, were in effect. A few programs were terminated or became inoperative. These included the Des Moines, the Richmond, the Omaha, and the Lincoln milk licenses; the alcoholic beverage importing industry, the California deciduous fruits, the watermelon industry, and the package-bee shippers' marketing agreements and licenses; the Arkansas grape, the Oregon cauliflower, and the Florida celery marketing agreements and orders; and the New York milk marketing agreement and order (suspended from January 31 to July 1, 1939).

As in past years, continuous legal attention was afforded to the promulgation, administration, and termination or suspension of these basic programs. Numerous legal instruments were prepared in the Office. These included proposed marketing agreements, orders, and amendments; prorate, grade, and size orders; orders selecting control committees, State advisory committees, growers' committees, control boards, and other agencies under marketing agreements and orders; orders directing that referendums be conducted; orders approving budgets and fixing current expenses of control committees; orders with respect to the discharge of trustees; orders approving the actions and procedures of control committees; and designations, amendments to designations, and terminations of designations of market administrators. A great deal of evidence was reviewed, and several opinions were rendered in connection with investigations of suspected violations of orders. Many memorandums of laws were written.

Much legal activity resulted from the regulations of anti-hog-cholera serum and hog-cholera virus in conformity with sections 56 to 60, inclusive, of the act of August 24, 1935 (49 Stat. 781).

CASES OF INTEREST

Collaborating with the Department of Justice, the Office aided in the prosecution of many cases appertaining to marketing agreements and orders. Of the 115 cases handled, 52 of which were pending from previous years, the majority involved milk and its products. Permanent injunctions against violations of the orders were issued in most of the 23 cases closed during the year, while temporary injunctions were secured in nearly all of the pending cases. The Office also assisted in an action in the Court of Claims for reimbursement of expenses incurred in connection with an early butter-stabilization agreement. Furthermore, 6 criminal actions on the west coast were successfully prosecuted.

As in the previous years, there was a thorough attempt to establish the Agricultural Marketing Agreement Act of 1937, as amended, as a constitutional regulation of interstate commerce. Three cases of particular import were decided during the year.

The cases of *H. P. Hood & Sons, Inc., et al.* v. *United States et al.*, 307 U. S. —, and *United States* v. *Rock Royal Cooperative, Inc., et al.*, 307 U. S. —, involved the constitutionality of the act, as applied in orders of the Secretary regulating, respectively, the handling of milk in the Greater Boston marketing area and in the New York metropolitan marketing area. In the former case, the earlier stages of which were briefly referred to in last year's report, the district court, on the basis of the special master's report, sustained the act and order. The defendants appealed to the circuit court of appeals, and were later granted writs of certiorari by the Supreme Court. The *Rock Royal* case was instituted by the United States to procure a mandatory injunction requiring the defendants to comply with the New York order. The district court held the act and order unconstitutional, and the United States appealed directly to the Supreme Court. In opinions handed down on June 5, 1939, the Supreme Court sustained the validity of both orders. Under the mandate of the Supreme Court in the *Hood* case, nearly $3,000,000 in equalization funds, which had been deposited in the registry of the district court in conformity with the writs of supersedeas issued by the circuit court of appeals, will be available for distribution to producers of milk handled in the Greater Boston area.

Another important decision bearing on the validity of the act, as applied to products other than milk, was obtained. The United States Circuit Court of

Appeals for the Ninth Circuit in *Wallace* v. *Hudson-Duncan & Co.*, 98 F. (2d) 985, reversed the adverse holding in *Hudson-Duncan & Co.* v. *Wallace*, 21 F. Supp. 295, and held the walnut order to be valid.

SURPLUS COMMODITIES

The Office rendered considerable legal assistance respecting the activities of the Department pertaining to surplus commodities. Legal services, including the preparation of all legal instruments, were performed in connection with more than 100 surplus commodity-removal and diversion programs.

Attorneys of the Office were called upon to advise and assist the Federal Surplus Commodities Corporation on numerous questions relative to contracts, agreements, orders, bylaws, and other corporate procedure. The food-order-stamp program, which was inaugurated by the corporation in three cities and which will probably be extended to many other localities, entailed considerable research, the preparation of many instruments, and the drafting of numerous regulations and conditions governing the issuance of stamps, establishing the eligibility of stamp holders to receive agricultural commodities and products, and providing for the payment of claims made by retailers.

TRANSPORTATION CHARGES ON FARM PRODUCE

Under section 201 of the Agricultural Adjustment Act of 1938, as amended, which authorizes the Secretary of Agriculture "to make complaint to the Interstate Commerce Commission with respect to rates, charges, tariffs, and practices relating to the transportation of farm products, and to prosecute the same before the Commission," attorneys of the Office made several appearances before the commission on behalf of the Department in cases pertaining to watermelons, citrus fruits, cotton, wheat, and other commodities.

ADMINISTRATIVE HEARINGS

Attorneys of the Office presided over 31 hearings on marketing agreements, orders, and amendments. Related legal documents were prepared, and 11,207 pages of testimony were taken, reviewed, and digested.

During the year, 51 petitions were filed under section 8c (15) of the act of May 12, 1933, as amended and as reenacted by the Agricultural Marketing Agreement Act of 1937, as amended. After consolidation, attorneys of the Office presided over 6 hearings and made recommendations to the Secretary concerning their disposition.

TITLE DIVISION

Through the cooperative efforts of the Lands Division of the Department of Justice, of the bureaus of the Department which are engaged in the purchase of land, and of this Office, land acquisition, both by direct purchase and by condemnation, was handled more expeditiously than in previous years, and the average time required for closing the acquisitions was substantially reduced. Furthermore, under a new arrangement between the two Departments, whereby attorneys of this Office were detailed to assist the courts in the distribution of funds deposited in condemnation cases, the delays incident to the courts' allocation of condemnation awards were greatly alleviated.

During the year, there were presented for review 7,932 abstracts of title, covering 2,509,453 acres of land located in 42 States and in Puerto Rico. The examination of 6,367 abstracts, pertaining to 2,001,473 acres of land, valued at about $8,000,000, was completed. Title to 1,222,828 acres of that land was vested in the United States, and the payment of purchase moneys therefor, in the total amount of $4,957,757, was approved.

Because of the inability of landowners to grant clear title to optioned lands, the Government instituted 1,719 condemnation actions, covering 439,235 acres of land. Many of the cases were instituted late in the year. Therefore, only 907 cases, involving 306,905 acres, were closed. Many of the pending proceedings are in their final stages, however, and payments of purchase moneys on the properties will probably be authorized within a short time.

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REPORT OF THE CHIEF OF THE SUGAR DIVISION, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
SUGAR DIVISION,
Washington, D. C., November 1, 1939.

HON. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith the report of the Sugar Division for the fiscal year ended June 30, 1939.

Sincerely yours,

JOSHUA BERNHARDT, *Chief.*

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SUGAR ACT OF 1937

When the House Committee on Agriculture on July 2, 1937, recommended passage of the Sugar Act of 1937 it expressed the opinion that the principles outlined in the President's message to the Congress of March 1 of that year with respect to sugar legislation were essentials of adequate and fair sugar legislation and that the bill then being reported (and subsequently enacted) carried out such principles. These were "that adequate safeguards to protect all interests be provided in the legislation; that the consumer be protected against unreasonable prices; that our foreign markets be protected by retaining the share of foreign countries in the established quotas; that if the domestic sugar industry is to obtain the advantage of a quota system it ought to be a good employer and to carry this out, legislation should prevent child labor and assure reasonable wages; that the small family size farm should be encouraged by the payment of higher benefits; and that an excise tax should and ought to be imposed on sugar manufacturing."

The legislation sought attainment of these objectives through a quota system which regulated imports and marketings of sugar in

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the United States and through conditional payment programs in all domestic sugar-producing areas.

EFFECT OF PROGRAM ON INCOME OF DOMESTIC PRODUCERS

It is anticipated that under the sugar program sugar-beet growers will receive an average of about $6.52 per ton of beets, including conditional payments, or approximately 97 percent of parity, for the record 1938 crop. This figure does not include the special conditional payments which the act authorizes in cases of acreage abandonment or crop deficiency. The total income of these growers is expected to be about $75,500,000 for the 1938 crop of 11,614,000 tons of beets, compared with $7.20 per ton, or around $63,000,000, for the 1937 crop of 8,770,000 tons. Conditional payments included in these totals amounted to $22,106,000 and $17,130,000 for the 1938 and 1937 crops, respectively.

The record Louisiana 1938 crop of 5,859,000 tons of sugarcane brought the growers approximately $3.60 per ton. The total income of these growers from the 1938 crop will be $21,000,000 compared with $20,500,000 from the 1937 crop of 5,258,000 tons. The income from the 1938 crop included about $5,900,000 in conditional payments, or approximately $1 per ton of cane. The income from the 1937 crop included about $4,900,000 in conditional payments.

TABLE 1.—*Conditional payments made to growers under the Sugar Act of 1937*

[As of June 30, 1939]

	1937 program	1938 program [1]
Continental sugar beet:		
California	$3,728,346.16	$4,506,775.03
Colorado	3,667,251.50	3,534,431.66
Idaho	1,170,163.55	2,073,789.11
Illinois	40,585.66	88,948.45
Indiana	91,867.37	147,813.11
Iowa	50,456.00	112,966.07
Kansas	105,242.01	153,735.83
Michigan	1,105,643.43	2,042,977.87
Minnesota	482,487.17	671,456.62
Montana	1,687,220.28	1,945,852.14
Nebraska	1,612,605.94	1,947,947.21
Nevada		12,163.46
New Mexico	789.75	3,100.00
North Dakota	262,698.28	278,789.18
Ohio	327,312.18	706,722.27
Oregon	115,080.49	223,527.22
South Dakota	103,204.35	212,493.04
Utah	1,065,997.26	1,434,812.24
Washington	207,754.20	387,596.45
Wisconsin	152,184.31	310,591.67
Wyoming	1,153,096.86	1,309,176.07
Total	17,129,986.75	22,105,666.70
Continental sugarcane:		
Florida	486,647.35	664,762.45
Louisiana	4,894,653.87	5,900,204.17
Total	5,381,301.22	6,564,966.62
Insular region:		
Hawaii	4,174,667.37	8,593,885.33
Puerto Rico	9,471,022.39	9,250,000.00
Total	13,645,689.76	17,843,885.33
Grand total	36,156,977.73	46,514,518.65

[1] These data include obligations totaling about $13,950,000 which had not been paid by June 30, 1939.

The returns of Hawaiian plantations, which grow about 90 percent of the cane produced in the Territory, from the 1938 crop were less favorable than in recent years partly because of lower sugar prices and partly because the crop was deficient in quality.

In the 1937–38 crop, Puerto Rican producers were permitted to harvest all standing cane, pursuant to the last clause of section 301 of the act exempting from marketing limitations the first crop harvested after enactment of the legislation. Conditional payments, however, were made only on the growers' allotments or "proportionate shares" as they are termed in the act. In the 1938–39 program the exemption provision did not apply. That program provided for payments on a smaller production of sugar than in the previous year since a surplus totaling about 340,000 tons of sugar had accumulated in the island between invalidation of crop adjustment in January 1936 and its resumption in the 1938 crop. It is estimated that the total income of Puerto Rican growers from the 1938–39 crop of 6,875,000 tons of sugarcane will be approximately $37,000,000.

Although data on income of processors in the various domestic sugar producing areas for the period covered by this report are meager, it is clear that there has been some decline in processors' income this year. Only the following information on important operating groups in the different areas is now available.

The stated net income of five beet-sugar processors for their last fiscal year, which ended in the spring of 1939 and which covered 67 percent of the 1938 crop production and sales from the 1937 and 1938 crops, averaged 5.22 percent of their reported capital and surplus, after provision for Federal income taxes. Three Puerto Rican processor-producers, covering 32 percent of the 1937–38 crop, reported net income for the fiscal period ended in early summer, 1938, as 9.01 percent of their stated net worth, and for the two companies reporting on the 1938–39 crop net income of 4.82 percent of net worth was shown. Thirty-two Hawaiian processor-producers, representing about 90 percent of the industry, reported a loss of approximately 2.50 percent of their stated net worth for the 1938 calendar year.

The processor-producer in Florida who produced about 95 percent of that State's 1938 crop of sugar reported a 10.96 percent net return on the stated net worth for the fiscal year ended June 30, 1939, while two corporations in Louisiana engaged in the combined operations of cane growing, raw sugar producing, and sugar refining, stated their net income for the 1938 crop period, as 4.68 percent of their average net worth.

POSITION OF CONSUMERS UNDER SUGAR PROGRAM

In recommending passage of the Sugar Act the House Committee on Agriculture expressed the belief that no hardship to the consumer would result from its provisions, but that on the other hand he would profit by a stabilized reasonable price.

The following tabulation shows the average retail price of refined sugar in the United States as reported monthly by the Bureau of Labor Statistics during the past fiscal year.

1938	Average retail price (cents per pound)	1939	Average retail price (cents per pound)
July	5.265	January	5.162
August	5.211	February	5.115
September	5.133	March	5.112
October	5.141	April	5.115
November	5.158	May	5.136
December	5.174	June	5.162
		Average	5.156

Because of a change made by the Bureau of Labor Statistics in October 1937 in the method of securing and compiling retail prices, certain adjustments must be made in the Bureau's figures before comparison with prior years' figures can be made. The average of 5.156 cents per pound for the fiscal year 1938-39 appears to be the equivalent of 5.30 cents per pound under the former method of reporting. This figure compares with 5.53 and 5.63 cents in the fiscal years 1937–38 and 1936–37, respectively.

The retail price figures for recent months of 1939 are as follows: July, 5.174; August, 5.167; and September, 6.442 cents per pound. The price of sugar in September was dominated by the outbreak of the European war.

ADMINISTRATION OF THE SUGAR-QUOTA PROVISIONS

The initial estimate of sugar requirements of consumers in the continental United States of 6,832,157 short tons of sugar, raw value, and the allocation of quotas for the calendar year 1939 was announced on December 3, 1938.

Because of misunderstanding in some of the sugar-producing areas concerning the basis for estimating consumers' sugar needs, the Sugar Division, in a letter made public on January 11, 1939, explained how the estimate for the year 1939 had been made. After quoting the standards specified in the act for making the determination, it was pointed out that—

* * * the Secretary is directed to use as the basis for his determination the quantity of direct-consumption sugar distributed for consumption as indicated by official statistics during the twelve-month period ending October 31 next preceding the calendar year for which the determination is being made. For the twelve-month period ending October 31, 1938, the preliminary official statistics of the Department of Agriculture on sugar distributed by manufacturers and importers show a total of 6,425,000 short tons, raw value.

The Secretary is next directed to make allowances for a deficiency or surplus in inventories of sugar and for anticipated changes in consumption arising out of changes in population and demand conditions. As of October 31, 1938, the inventories of sugar in the hands of primary distributors (manufacturers and importers of direct-consumption sugar) were somewhat in excess of the stocks in the immediate preceding years. * * *

* * * the preliminary data on 1938 primary distribution show some decline from the 1936 and 1937 levels as a result of the depressed economic conditions that prevailed during the past year. Since experience demonstrates that there is a tendency for the per capita consumption of sugar to fluctuate with changes in consumers' purchasing power, and since the indications are that consumers' purchasing power for 1939 will be greater than it was in 1938, the demand for sugar may be expected to increase somewhat during 1939 as compared with 1938.

By taking the foregoing base of 6,425,000 short tons of sugar, raw value, and then making statistical allowances, first, by deducting an estimated surplus in inventories and second, by adding an amount to cover the expected increase in per capita consumption a net figure will be obtained which is less than the total quota supplies for the past several years. The act provides that "addi-

tional allowances" be made to the base "so that the supply of sugar made available under this act shall not result in average prices to consumers in excess of those necessary to maintain the domestic industry as a whole." If the total quota supplies for 1939 were smaller than the total quota supplies for 1937 and 1938 by the amount indicated above, the result, according to data available to this Department would be "average prices to consumers in excess of those necessary to maintain the domestic industry as a whole." There has been a substantial expansion of domestic production during recent years under the price conditions which have obtained under the determinations of total quota supplies of 6,812,687 tons in 1936, 7,042,733 tons in 1937, and 6,780,566 tons in 1938. Under these circumstances, an "additional allowance" is required.

The act provides that the amount of such additional allowances shall be such "that in no event will the amount of the total supply be less than the quantity of sugar required to give consumers of sugar in the continental United States a per capita consumption equal to that of the average two-year period 1935–36." The determination of 6,832,157 tons made by the Secretary for 1939 gives effect to the minimum "additional allowance" and corresponds on a per capita basis to the average consumption of the two years 1935 and 1936; it is also the same, on a per capita basis, as the determination for 1938. It was believed at the time the determination was made that this minimum additional allowance would be sufficient to prevent prices to consumers "in excess of those necessary to maintain the domestic sugar industry as a whole."

Subsequently, in response to various inquiries received in the Sugar Division for further explanation of the Department's interpretation of the quota provisions of the act, a press release was issued February 20, 1939, pointing out that the provisions of section 201 of the act expressly authorize the Secretary of Agriculture to revise the initial determination of consumers' requirements for each calendar year "at such times during such calendar year as the Secretary may determine necessary." The Division stated as its opinion that the per capita minimum specified in the act necessarily applies only in the event that the computations under the other provisions of section 201 would result in prices "in excess of those necessary to maintain the domestic sugar industry as a whole."

Marketing or importations of sugar in 1937 and 1938, and the quotas which were in effect in 1939 until they were suspended on September 11 by presidential proclamation are shown in the following table:

TABLE 2.—*Sugar marketings or importations under the Sugar Act of 1937* [1]

[Short tons, raw value]

Area	1937	1938	1939 [1]
Domestic areas:			
Domestic beet sugar	[2] 1,238,142	[2] 1,470,627	1,566,719
Mainland cane sugar	457,051	446,294	424,727
Hawaii	985,031	905,572	948,218
Puerto Rico	896,340	815,293	806,642
Virgin Islands	7,841	3,924	9,013
Total domestic	3,584,405	3,641,710	3,755,319
Foreign countries:			
Commonwealth of the Philippine Islands	991,020	981,146	[3] 981,912
Cuba	2,155,218	1,940,823	1,932,343
Foreign countries other than Cuba	89,155	75,114	85,812
Total foreign	3,235,393	2,997,083	3,000,067
Total	6,819,798	6,638,793	6,755,386
Total of quotas as established in regulations	7,042,733	6,780,566	6,755,386

[1] For 1937 and 1938, the figures represent actual importations or marketings against the quotas. For 1939 there are shown the quotas which were in effect prior to their suspension by Presidential proclamation on Sept. 11, 1939.

[2] Final quotas established for beet area (without deductions for deficits) were 1,633,361 tons in 1937 and 1,584,083 in 1938.

[3] Represents duty-free quota, since balance was allotted to foreign countries other than Cuba.

The Sugar Act provides that deficiencies found in any area's quota supply may be reallocated to other areas able to market sugar, without affecting the statutory quota for the area in which such deficiency is found. In accordance with this provision deficits found in 1938 in Hawaii, the Virgin Islands, and the Commonwealth of the Philippine Islands, were reallocated. It should be noted that even after an expected deficiency in any sugar-producing area has been reallocated there can be no assurance that the total supplies actually made available by sellers will be equal to the total amount of sugar which is permitted to be marketed. In fact, the actual quantities of sugar marketed or imported under the quotas in recent years have been considerably less than the total of the quotas as established in the regulations. In 1937, after area deficits had been reallotted, actual marketings were 222,935 tons under the total of the quotas, while in 1938 the deficiency was 141,773 tons. Consequently, the comparisons which have been made of the actual distribution of sugar to consumers in any year with the total of the quotas shown in the regulations convey an erroneous impression.

As in previous years the Bureau of Customs of the Treasury Department cooperated with the Sugar Division in maintaining administrative control over imports of sugar at ports of entry.

SUGAR-MARKETING ALLOTMENTS

The act provides (sec. 205) that whenever the Secretary finds that the allotment of any area's sugar quota is necessary to assure all interested persons an equitable opportunity to market sugar, to prevent disorderly marketing, or for other purposes specified in the act, he is to make such allotment, after formal public hearing, in accordance with the standards specified in the legislation.

Marketing allotments became operative in 1939 in all of the domestic areas except Hawaii because sugar supplies in these areas were found to be substantially in excess of their quotas. In Puerto Rico such allotments have been in effect every year since 1934.

The public hearing for the purpose of receiving evidence to enable the Secretary to make a fair distribution of the mainland cane area's 1939 quota was held in Mobile, Alabama, on February 8 and 9, 1939, and that for the continental beet area, in Chicago on February 21 of the same year. Practically all processing companies were represented at these hearings.

The act requires that in making marketing allotments consideration is to be given to processings of sugar from beets or cane to which "proportionate shares" of growers pertained, to past marketings or importations of sugar, or to ability to market or import the quantity allotted. The "proportionate shares" referred to in this connection are, in effect, the growers' shares (with respect to which payments under title III of the act are made) of the quota and normal carry-over established for the sugar-producing area in which the grower is located.

One group of companies which did not have as large a proportion of its last crop unmarketed as did most other processors, proposed a formula which would give more weight to past marketing history than to production from the last crop. Another group of companies which

on January 1 had more than an average proportion of the last crop unmarketed, argued for formulas which would give dominant weight to either the last crop or the inventory left from that crop.

The marketing allotment orders for the mainland sugarcane and sugar-beet areas were based upon a formula giving 25 percent weight to past marketings of sugar and 75 percent weight to processings of sugar from the 1938 crop of sugarcane or sugar beets, the last crops with respect to which farm "proportionate shares" had been made effective. For the purpose of determining past marketings in the mainland cane area the most favorable of the following options was selected in the case of each processor: (1) 100 percent of the average quantity of sugar marketed during any 3 of the calendar years 1935, 1936, 1937, and 1938; (2) 80 percent of the average quantity of sugar marketed during any 2 of the calendar years 1935, 1936, 1937, and 1938; or (3) 70 percent of the average quantity of sugar marketed during any 1 of the calendar years 1935, 1936, 1937, and 1938. For the continental beet area past marketings were measured by average marketings during the calendar years 1936, 1937, and 1938. (The allotment orders here described were published in the Federal Register of May 2, 1939.)

Puerto Rican processors waived their right to a hearing on the allotments for both the island's 1939 quota for delivery in continental United States and the local consumption quota of Puerto Rico. Allotment of these quotas was made on the same basis as in prior years, the fundamental factor being the processors' grindings of the 1939 "proportionate shares" of individual growers, including the processor's own proportionate shares, if any.

A hearing was held in Washington, D. C., for the purpose of alloting the Puerto Rican direct-consumption sugar quota of 126,033 short tons for shipment to the continental United States. (The allotment orders for Puerto Rico will be found in the Federal Registers of January 10 and April 19, 1939.)

ADMINISTRATION OF CONDITIONAL PAYMENT PROGRAMS

The conditions for Federal payments to growers under the Sugar Act are stated in section 301 and cover nonemployment of child labor, payment of fair and reasonable wages to agricultural labor, payment of fair and reasonable prices for beets or cane bought from other growers, maintenance and improvement of soil fertility, and compliance with growers' "proportionate shares."

The wage and fair price conditions for payment require the Secretary of Agriculture to make certain determinations or findings after investigation and public hearing.

"PROPORTIONATE SHARES" OF GROWERS

One of the conditions for Federal payments under the Sugar Act of 1937 is that a producer may not market sugar beets or sugarcane in excess of his farm's proportionate share of the total quantity of beets or cane needed to enable the area in which his farm is located to meet its quota (and provide a normal carry-over), for the year during which most of the crop would normally be marketed.

CONTINENTAL BEET AREA

In the continental beet area, which for several years had not filled its quota, it was not found necessary under the 1937 and 1938 programs to establish restrictive proportionate shares. In 1938, however, there was produced the largest beet-sugar crop on record and beet-sugar supplies for 1939 were expected to be in excess of the beet area's probable quota and normal carry-over. It therefore became necessary, under the provisions of the act, to establish effective proportionate shares for the beet area for the 1939 crop. The total proportionate share acreage which, it was estimated, would be required to fill the beet-sugar quota and provide a normal carry-over was established at 1,030,000 acres.

As a first step toward the establishment of proportionate shares for growers, conferences were held in the field with representatives of growers and processors for the purpose of discussing the various problems involved. It was agreed at these meetings that the most satisfactory method for making the distribution was to establish acreage allocations by factory districts and then to distribute among the growers within a given district the acreage allocated to the district.

The acreages to be allocated to growers in the various districts were established under the proportionate share determination issued December 23, 1938 (Federal Register, vol. 3, p. 3172). The determination provided that committees of sugar-beet growers, to be appointed by the Agricultural Adjustment Administration, were to work with representatives of sugar-beet processors in apportioning the acreage among the individual growers within the districts on the basis of "past production" and "ability to produce," the standards set forth in the act. Provision was also made in the determination for the protection of new and small producers.

MAINLAND CANE AREA

The amount of sugar which it was estimated would be needed to be produced from the 1939 crop of sugarcane in the mainland cane-sugar area, comprising Louisiana and Florida, to enable that area to fill its 1939 quota and provide a normal carry-over was announced by the Secretary on September 24, 1938, to be 406,000 short tons, raw value.

The determination of proportionate shares for the mainland sugarcane farms for the 1939 crop was issued on October 4, 1938 (Federal Register, vol. 3, p. 2378). It provided basically that in order to qualify for conditional payments with respect to the 1939 crop, growers should make a 25 percent adjustment from the 1938 level of the acreage in sugarcane marketed for sugar and that in no event was the proportionate share for any farm to be in excess of 60 percent of the farm's cropland suitable for the production of sugarcane. As in the case of the 1938 crop, special provisions were made for new and small producers. One of the provisions for the protection of such farmers was the establishment of a minimum proportionate share of 5 acres, while in the case of farms having 30 acres or less suitable for the production of sugarcane, it was announced that the proportionate share could be as much as one-

third of such acreage. These provisions enabled growers who have 10 acres or less in sugarcane, and who constitute the majority of the growers in this area, to qualify for conditional payments without making any acreage adjustment.

In the case of farms with more than 30 acres suitable for the production of sugarcane the proportionate share could be as much as 10 acres plus one-fourth of the acreage suitable for sugarcane in excess of 30 acres, provided there was plowed under a leguminous crop, in preparation for the 1938 fall planting of sugarcane, on an area equal to the difference between the proportionate share calculated on this basis and the proportionate share which would have been established provided the basic acreage adjustment had been made. It was provided further that the proportionate share for any farm could be as much as the sum of the acreage of first stubble cane and that of new plant cane planted on the farm before October 1, 1938, but not more than the 1938 proportionate share. The determination was amended on February 1, 1939, so that small established growers who marketed 18 acres or less of sugarcane for sugar in 1938 would not be required to make further acreage adjustment in 1939 in order to qualify for payment (Federal Register, vol. 4, p. 505).

On February 1, 1939, there was also issued the proportionate-share determination for farms in the mainland sugar area for the 1940 crop (Federal Register, vol. 4, p. 506). This determination provided a basis for calculating the proportionate share for each grower for the 1940 crop and for the completion of the basic 25 percent acreage adjustment of 1939 which could not be made completely effective in that year. The growers affected by this provision were those who were not required to make the basic adjustment in 1939 because their acreage for harvest that year consisted mainly of plant and first-stubble cane.

HAWAII

Since the production of sugar in Hawaii in recent years, because of conditions adversely affecting the sugarcane crop and for other reasons, has not been in excess of the quantity required to fill the Territory's local consumption quota and the quota for marketing in the continental United States, it has not been found necessary to establish restrictive proportionate shares for growers who wished to qualify for Federal payments.

PUERTO RICO

Because of the continued presence of relatively large sugar surpluses in Puerto Rico, restrictive proportionate shares were again needed for the 1939 crop.

The proportionate share determination for Puerto Rican farms for the crop year 1939 was originally issued on January 11, 1938 (Federal Register, vol. 3, p. 75). On November 18, 1938, there was announced an amendment providing for equitable treatment for growers who had a production history during the base period used for determining proportionate shares of Puerto Rican growers but who had not produced sugarcane in the years subsequent to the base period. The amendment also fixed 845,739 short tons, raw value, as the amount of sugar which would be required from the 1938–39 crop in order to enable

Puerto Rico to fill its quota and maintain a normal carry-over. This amount, which was approximately 100,000 tons less than for the 1938 crop, was prorated among all sugarcane producers in the island on the basis of each grower's base production. At the same time there was issued the determination of proportionate shares for the 1940 crop (Federal Register, vol. 3, p. 2747), providing for substantially the same proportionate share basis as in previous years.

On December 29, 1938, it was announced that applications for new proportionate shares for 1940 would be allowed only for growers who had completed their plantings on or before December 31, 1938, and the action was given formal effect in an amendment to the 1940 determination issued on February 14, 1939 (Federal Register, vol. 4, p. 901). This action was taken to prevent an excessive transfer of acreage from the old growers to new growers. Prior to this ruling about one-fifth of the total Puerto Rican proportionate shares had been transferred from old to new growers.

FARMING PRACTICES

Another of the conditions for payment to sugarcane or sugar-beet producers under the act is that they carry out certain farming practices "for preserving and improving fertility of the soil and for preventing soil erosion, such practices to be consistent with the reasonable standards of the farming community in which the farm is situated."

MAINLAND CANE AREA

On May 10, 1939, there was issued the determination of farming practices to be carried out in connection with the production of the 1939 crop of sugarcane in the mainland cane area (Federal Register, vol. 4, p. 1998). The soil-building-practice requirements for the 1939 crop are the same as in 1938 except for minor changes made in accordance with the recommendations of the State Agricultural Conservation Committees of Louisiana and Florida.

CONTINENTAL BEET AREA

Under the 1938 beet program the practices provided as a means of meeting this condition for payment included the seeding and maintenance of adapted biennial and perennial legumes and perennial grasses, the use of green-manure crops, and the application of barnyard manure and commercial fertilizers.

In the case of the 1939 program (Federal Register, vol. 4, p. 382), the practices provided were much the same as under the program of the previous year. However, in order to stimulate increased plantings of soil-conserving crops, double credit was given for the seeding of alfalfa. The majority of sugar beet producers in the United States have in the past carried out practices which conform closely to the requirements established under the sugar program.

HAWAII

The determination of farming practices to be carried out in connection with the production of Hawaiian sugarcane during the crop year 1939 was issued on April 19 of that year (Federal Register, vol. 4,

p. 1649). The minimum fertilizer requirements are substantially the same as those for the previous crop.

PUERTO RICO

The determination of farming practices to be carried out in connection with the production of Puerto Rican sugarcane during the 1938–39 crop season was issued on July 20, 1938 (Federal Register, vol. 3, p. 1786). The minimum fertilizer standards were substantially the same as those for the 1937–38 crop year.

On April 29, 1939, the farming-practice determination was amended to enable producers on farms containing more than 10 but not more than 100 acres and located in certain dry areas where the methods of preserving and improving soil fertility do not include the use of chemical fertilizer, to qualify for payment by performing the soil-building practices recommended for Puerto Rico under the Agricultural Conservation Program (Federal Register, vol. 4, p. 1740).

PROCESSOR-GROWER RELATIONS

Processors who as producers wish to apply for conditional payments are required under section 301 (d) of the act, to pay for sugarcane or sugar beets purchased from other producers at rates not less than those determined by the Secretary, after investigations and public hearing, to be fair and reasonable. Since the passage of the Sugar Act and its approval on September 1, 1937, 37 hearings under the authority contained in sections 301 (d) and 511 of the act, have been held in the 4 domestic areas. (Section 511 authorizes the Secretary to make surveys, investigations, including the holding of public hearings, and to make recommendations with respect to contracts between growers and processors, and growers and laborers.)

A substantial percentage of all domestic sugarcane is grown by processor-producers. These processor-producers receive relatively large Federal payments if they comply with the several conditions set forth in the act. Consequently, the terms of determinations with respect to fair and reasonable prices become the general basis for the purchase of sugarcane. This is not so true in the sugar-beet industry since sugar-beet processors grow less than 1 percent of the beets processed by them and receive less than 1 percent of the conditional payments made in the beet-sugar area.

CONTINENTAL BEET FAIR PRICE DETERMINATIONS

Purchase agreements, in the majority of cases identical with those used in 1938, have been made for the 1939 crop of sugar beets. The determination with respect to the 1939 crop (Federal Register, vol. 4, p. 3645) accepted the rates incorporated in the contracts between processors and producers as providing an equitable basis for the purchase of this crop. Information obtained at public hearings and from general investigations of the financial results of the agreements under which the crop of the previous year had been purchased indicated that as a result of the tax and conditional payment program and changes made in recent years in the purchase agreements, a generally reasonable distribution of income in the sugar-beet industry resulted for that crop period.

Many of the issues involved in contracts between beet growers and processors have been discussed at some length in a preliminary report with respect to grower-processor relationships in the beet-sugar industry. This preliminary report was issued in April 1939, following investigations and public hearings. The report summarizes the general characteristics of the sugar-beet industry affecting processor-grower relations and reviews early governmental activities relative to beet contracts. Problems pertaining to the processor-grower relationship are analyzed under the following topics: (1) distribution of income from sugar beets; (2) alternative principles applicable to the determination of the price of sugar beets; (3) types of contracts used to effectuate a distribution of income based on the participation principle; (4) regional factors affecting the income from sugar beets; (5) issues other than price involved in processor-grower contracts.

MAINLAND CANE FAIR PRICE DETERMINATIONS

The determination for the 1938 crop for Louisiana followed that of 1937 with two modifications. The 1937 system of premiums and discounts for high and low quality cane was found to result in a lower payment per pound of recovered sugar when the quality of sugarcane was high than when it was average or below average. To remedy this defect provision was made in the 1938 determination for a slight increase in premiums for high-quality cane. The second of these changes, made at the request of growers and processors, permitted for settlement purposes, as an alternative to the use of the season average price, the use of the average weekly quotations for 96° raw sugar, duty-paid basis, for the week in which sugarcane was delivered.

The 1939 determination for Louisiana (Federal Register, vol. 4, p. 4224) continued the one for 1938 with slight modifications. It provided that the grower receive $1 per ton of standard sugarcane at a 3.50-cent level of raw sugar prices, with a 3 percent reduction in the basic rate for each quarter cent decline down to 2.75 cents and a 3 percent increase for the first quarter cent increase above 3.50 cents per pound. Premiums and discounts were fixed for cane above or below the quality of standard cane. Under this system price variations are reflected in a greater degree in the returns to growers than in those to processors. Producers indicated approval of the contract at the public hearings.

In view of the fact that sugar production in the mainland cane area has increased greatly in recent years, interested persons requested in the fall of 1939 that where settlement is made on the basis of a season average price, the length of the period be increased so as to permit the market to absorb the total crop without undue depression of price. Therefore, the 1939 determination extends the time period used in the calculation of the price basis of settlement from 20 to 30 weeks. In addition, provision is made for the sharing between processors and producers, subject to mutual consent and to the approval of the Secretary or his authorized agent, of transportation costs in those instances where the only practicable means of shipment is by rail and where the distance is great.

Although the fair price determination for the 1938 crop had provided that the processor should not through any subterfuge or device reduce the return to growers below those provided for in the determination, certain processors, apparently under a misapprehension as to

the meaning of the provision, altered their customary business practices either by refusing to grant growers a weighing and loading allowance where this had been the custom, or by requiring the grower to perform these services which had previously been performed by the processor. Where changes of the above type were made in customary practices, processors were deemed not to have fulfilled the condition with respect to the payment of fair and reasonable prices. In order to clarify this requirement, the 1939 determination specifically provides for the continuation of customary practices.

In the case of Florida, where there are only 13 independent growers engaged in the production of sugarcane, the purchase agreement in use was approved.

PUERTO RICAN CANE FAIR PRICE DETERMINATIONS

The legislative assembly of Puerto Rico has enacted legislation under which it is required that growers be paid for their cane on the basis of a stipulated percentage of the value of recovered sugar, the percentage varying slightly with the quality of the cane, the value of the sugar being calculated on a New York basis. The principles of this legislation have been adopted in the fair-price determinations for Puerto Rican processors who, as producers, apply for conditional payments.

The 1938–39 determination (Federal Register, vol. 4, p. 1007) required processors to pay growers an amount for each ton of cane equal to not less than 63 percent of the f. o. b. mill value of the sugar recovered from the cane delivered, or the amount which would have been paid under the contract employed in 1937, whichever figure was larger. Settlement for sugarcane deliveries was to be made on the same basis as in 1937, except that such liquidations were to be fortnightly or monthly, as might be agreed upon between grower and grower-processor.

The 1938 determination stipulated that an allowance of not more than 25 cents per hundredweight be made from the New York price in arriving at the f. o. b. mill value to be used for settlement purposes. This expense appears to have increased in 1938; hence a limitation of 27 cents per hundredweight is fixed in the 1939 determination. The 1939 determination also included an alternative formula found in Puerto Rican legislation relative to sugarcane contracts.

HAWAIIAN CANE FAIR PRICE DETERMINATIONS

Not more than 10 percent of the sugarcane produced in the Hawaiian Islands is purchased, the remainder being produced by plantation-producers. Production by the so-called adherent planters, the semi-independent producers of the area, is concentrated in the nonirrigated districts. Some of the adherent planters operate on their own land, others on land leased from owners other than plantation producers, while a group constituting approximately 70 percent of the total number of adherent planters lease land controlled by the plantation producers through either ownership or lease.

The plantation producer customarily enters into an agreement with the adherent planter to purchase at rates set forth in the agreement all of the sugarcane produced, the rates generally being contingent upon the price of raw sugar and in many instances the quality of the cane. Contracts in force between adherent planters and proc-

essor-producers, and which cover 60 percent of the total number of adherent planters, provide for a payment to the planter of $1.20 per ton of cane for each 1 cent of the per pound price of sugar, for cane of 8¼ quality ratio. (Quality ratio represents the number of tons of cane required to produce 1 ton of sugar.)

At the public hearings the adherent planters, through their association representatives, requested that the contracts in use at the time of the passage of the Sugar Act of 1937 be continued, and that the conditional payment be shared with the processor-producer. Determinations with respect to the 1937 and 1938 crops provided that the rates agreed upon between the adherent planters and the plantation producers would be deemed fair and reasonable.

Under the terms of the purchase contract most generally in use the adherent planter receives a price equal to slightly less than one-half the value of the sugar recovered, on a basis of New York duty-paid prices. In addition, under a supplemental agreement entered into between adherent planters and processor-producers, the adherent planter is guaranteed subsistence advances not to exceed $40 per acre per crop period, repayment being required only in the event that the final liquidation is sufficient to retire the indebtedness of the planter. The adherent planter receives as his share of the Government conditional payment $6 per ton of raw sugar recovered from the cane delivered by him.

In view of the apparent complete accord existing between the Hawaiian producers and the processor-producers, no change was deemed desirable, and the 1939 determination (Federal Register, vol. 4, p. 1742) approves as fair and reasonable the rates in the contracts now in force for that crop period.

FAIR AND REASONABLE WAGE-RATE DETERMINATIONS

One of the conditions for payment to producers is that persons employed in the production, cultivation, or harvesting of beets or cane be paid in full for all such work, at rates not less than those determined by the Secretary, after public hearing and investigation, to be fair and reasonable. In making such determinations the Secretary is instructed to take into consideration the standards formerly established by him under the Agricultural Adjustment Act, as amended, and the differences in conditions among various producing areas.

CONTINENTAL BEET AREA

Since the Sugar Act of 1937 became effective on September 1, 1937, four wage determinations have been issued for the sugar-beet area.

The determination of September 19, 1938, which revised that of April 4 of the same year, was issued in order to adapt the determination to some particular local situations and wage practices. Certain changes were also made in the grouping of some of the western beet-producing areas. Like the original determination, it established piece rates for the various hand operations performed in the production, cultivation, and harvesting of the 1938 sugar-beet crop. In the case of California, Nevada, Washington, and parts of Oregon minimum hourly rates were established in addition to piece rates.

Wage determinations for workers employed in the production of the 1939 beet crop were issued on November 25, 1938, and on March

30, 1939. The first of these covered California, where the planting season is much earlier, and the second the remaining beet States. Hearings for California were held in August 1938 and for the other States at various points in the beet area during January 1939. The determination for California did not change significantly the general level of wage rates previously established. Minor adjustments were made with respect to the wage differential between northern and southern California. Piece and hourly rates were again provided for with slight reductions in the hourly rates for harvesting the 1939 crop.

The wage determination of March 30, 1939 (Federal Register, vol. 4, p. 1378), which covered all the beet States except California, represented a reduction of approximately 4 percent from the 1938 level of wages established for the beet area due principally to revisions in the harvesting rates set for 1938.

While no hourly rates were specifically provided for hand operations on the 1939 crop in any of the States other than California, Washington, Nevada, and parts of Oregon, the determination made it possible for producers in other States to pay their laborers for the specified operations on a time-unit basis provided the rates actually agreed upon by the producer and laborer were approved by the State agricultural conservation committee as being equivalent to the established piece rates. The determination also carried a provision enabling growers to apply for special piece rates in instances where the use of special machine methods reduced the amount of labor required as compared with the method ordinarily used. Such rates, however, also had to be approved by the State committee as being equivalent to the piece rates established in the determination for the part of the work actually performed.

The wage rates established for the 1939 crop for the several sugar-beet areas were as follows:

NONIRRIGATED AREAS

Area	Blocking, thinning, and hoeing (per acre)	Harvesting (9 tons)	Total (per acre)
Minnesota, Iowa, and Eastern North Dakota	$12.00	$7.90	$19.90
Ohio, Michigan, Indiana, and Wisconsin	11.00	8.37	19.37

IRRIGATED AREAS

Area	Blocking and thinning (per acre)	First hoeing (per acre)	Second hoeing (per acre)	Harvesting (12 tons)	Total (per acre)
Southern California	$6.50	$1.50	$1.00	[1] $11.52	[1] $20.52
Northern California	7.50	2.00	1.50	[1] 12.72	[1] 23.72
Washington	7.50	2.00	1.50	[1] 12.00	[1] 23.00
Utah, Idaho, and Oregon	8.00	2.00	1.00	[1] 11.64	[1] 22.64
Southern and Eastern Montana, Northern Wyoming, Western North Dakota	9.50	2.50	1.50	9.60	23.10
Western Montana	8.50	3.00	2.00	9.60	23.10
Northern Montana	8.50	3.00	2.00	[1] 11.40	[1] 24.90
Nebraska, Colorado, Southern Wyoming, South Dakota	8.00	2.50	1.50	9.60	21.60
Kansas	8.00	2.00	1.00	9.60	20.60

[1] Includes loading as well as topping.

Besides establishing minimum wage rates, all of the determinations have required each producer who wished to qualify for Federal payments, to furnish free of charge to laborers the perquisites customarily furnished by him, such as a house, garden plot, and similar incidentals.

MAINLAND CANE AREA

Between the time the Sugar Act of 1937 went into effect and the close of the fiscal year there have been six wage determinations for the mainland sugarcane area, two of which have been revisions of earlier determinations. The first determination issued under the act was on November 12, 1937, and it covered the harvesting operations on the 1937 crop in Louisiana. This determination was followed by a revised determination, issued on March 30 of the following year, which included the 1937 sugarcane harvest rates for Florida as well as those previously issued for Louisiana.

On July 2, 1938, the Secretary approved a wage determination for labor employed in the planting and cultivating of sugarcane in Louisiana and Florida during that year. The required public hearings had been held in the two States in the winter of 1937–38. This determination required the payment by Louisiana producers of not less than $1.20 and $1 per day for adult male and female workers, respectively, engaged in this type of work. In Florida the wage rates were to be not less than $1.60 and $1.30 for adult male and female workers, respectively.

Wages for labor employed in the harvesting of the 1938 crop in the mainland cane area were established in a determination issued on October 15 of that year. Five public hearings for the purpose of obtaining information had been held at various places in Louisiana and Florida in August 1938. The wage rates established were the same as those for the harvest of the 1937 crop, with the exception that they applied to a basic 9-hour working day.

The wage rates established for harvest labor in the 1938 crop were as follows:

1. *Louisiana.*—For cutting, topping, and stripping cane, adult male workers not less than $1.50, and adult female workers not less than $1.20, per day of 9 hours. For a working day longer or shorter than 9 hours, not less than 17 and 13 cents per hour for adult male and female workers, respectively.

For cutting, topping, and stripping cane on a tonnage basis, not less than 75 cents per ton.

2. *Florida.*—Separate rates were established for Florida for the different types of cane harvested, the rates varying from 65 cents to $1.10 per ton depending upon the size of the cane, and whether it was green or burnt. These rates included the cutting and loading of the cane.

It will be noted that the harvest rates established for Louisiana do not include loading, an operation which is paid for separately, such payment being in addition to the rates specified for cutting and topping.

A revision of the 1938 harvest determination, issued on February 16, 1939, amended the original determination by providing for day rates in harvesting operations in Florida as an alternative to the piece rates previously established. The amendment was made necessary because information indicating that certain Florida growers engaged harvest labor on a day basis became available after the public hearings had been held and the determination issued. There-

fore the revised determination provided for an additional rate of not less than $2 for adult male and $1.60 for adult female workers per day of 9 hours for cutting, topping, and stripping of cane in Florida. Since the producers to whom these day rates applied did not employ the same laborers for loading, the day rates established did not include the operation of loading.

On January 19, 1939, there was issued the wage determination covering laborers employed in planting and cultivating of cane during that year (Federal Register, vol. 4, p. 381). The required public hearings had been held in Louisiana and Florida in the early part of August 1938. The planting and cultivating wages determined for 1938 were continued in effect during the following year. Application of the day rates to a working day of 9 hours with hourly rates for days longer or shorter than 9 hours was, however, incorporated into this determination. The wage rates established were as follows:

1. *Louisiana.*—For adult male workers not less than $1.20, and for adult female workers not less than $1, per day of 9 hours. For a working day longer or shorter than 9 hours, not less than 13 and 11 cents per hour for adult male and female workers, respectively.
2. *Florida.*—For adult male workers not less than $1.60, and for adult female workers not less than $1.30, per day of 9 hours. For a working day longer or shorter than 9 hours, not less than 18 and 14 cents per hour for adult male and female workers, respectively.

In June 1939, the Sugar Division conducted public hearings in Louisiana and Florida for the purpose of obtaining evidence from producers' and laborers' representatives needed in the establishment of wage rates for the harvesting operations on the 1939 sugarcane crop.

Besides establishing minimum wage rates, all of the determinations for the mainland cane area have required each producer who wished to qualify for Federal payments, to furnish free of charge to laborers the perquisites customarily furnished by him, such as a habitable house, a suitable garden plot with facilities for cultivation, pasturage for livestock, medical attention, and similar incidentals.

PUERTO RICO

Within the past fiscal year only one wage determination was made in Puerto Rico. This determination covered wage rates for the calendar year 1939 and was issued on February 25 of that year (Federal Register, vol. 4, p. 1028). The only previous wage determination for Puerto Rico had been issued February 23, 1938, and it applied to 1938. Unlike other domestic sugar-producing areas, Puerto Rico has a well-established system of collective bargaining and written agreements between agricultural workers' organizations and producers of sugar. Since collective bargaining has been in effect in Puerto Rico for a number of years and it appears that the workers' organization enjoys considerable bargaining power in its dealings with the Puerto Rican sugar growers, the Department was able to accept with but minor modifications, as fair and reasonable for the determinations for both 1938 and 1939 the wage rates contained in the collective agreement signed by the workers' organization and the producers. During the two crop years that fair wage determinations have been effective in Puerto Rico there is no record that sugarcane labor has instituted any strikes or controversies involving wages.

The determination as issued on February 25, 1939, provided for minimum daily, hourly, and piece rates, and for overtime. The day rates applied to an 8-hour day (a 7-hour day for ditch makers and cleaners who work in water), with double pay for overtime. The day rates varied for specified operations from $1.10 in handling carts in nonharvest operations to $1.70 for driving tractor plows. These rates applied to farms located in the coastal area. For the relatively few producers located in the interior of the island the day rates for the same operations were slightly lower. A minimum day rate of $1 established for operations for which day rates were not specified was applicable to workers in both areas. The hourly rates were to be not less than the equivalent rates for an 8-hour day. Piece rates for 1939 were to be on the same basis as those for 1938 which in turn were to be not less than 110 percent of the piece rates for similar work fixed in the collective agreement for 1937. The 1939 determination also incorporated in effect a provision carried in the determination of the previous year requiring that minimum daily earnings of workers under a piece rate system be at least equal to the equivalent hourly and overtime payments.

HAWAII

Two new wage determinations and the revision of an earlier one were made for Hawaii within the past fiscal year. The revised determination was issued on July 7, 1938, and it supplanted the one issued in April of that year covering sugarcane operations during the period September 1–December 31, 1937. On November 25, 1938, a wage determination was issued covering the sugarcane operations performed in 1938, and on January 25 of the following year, one was issued applicable to all persons employed during 1939.

In connection with the determination issued on November 25, 1938, information obtained from the data submitted at the public hearings and from other sources indicated that the 1938 wage rates paid by producers in Hawaii were for the most part fair and reasonable. The wages paid that year included an increase voluntarily made by producers over the rates specified in the 1937 determination. Therefore, the wage determination issued accepted with one modification the 1938 wages which prevailed in Hawaii as fair and reasonable. This modification resulted in a wage increase equal to 5 percent for many sugarcane workers, in addition to the voluntary increase already effected by the producers. The average daily earnings for all short-term contract workers in Hawaii in 1938 were $2.34, compared with $2.06 in 1937 and $1.76 in 1936. Of these workers the average earnings per day for those engaged in harvesting operations were $2.45 in 1938, compared with $2.06 in 1937. For workers engaged in planting and cultivating operations the average daily earnings for 1938 were $1.98 compared with $1.72 in 1937.

In the 1939 determination (Federal Register, vol. 4, p. 410) there were established various minima for annual average daily earnings for specified operations and categories of workers. In addition a minimum wage per day for a pay period not to exceed 1 month was included for all workers engaged in any phase of sugarcane field work. The general level of wage rates for 1939 as contained in the determination was comparable with the rates prevailing in 1938. This deter-

mination also provided that the rates for adult female workers were not to be less than three-fourths of the rates specified for adult male workers. As in previous determinations, provision was made requiring each producer who wished to qualify for payments under the act, to furnish laborers free of charge with the perquisites customarily furnished by him.

FINANCES FOR THE SUGAR PROGRAM

The Department of Agriculture Appropriation Act, fiscal year 1939, provided an item of $48,000,000 for administration of the Sugar Act. This amount proved insufficient to cover the cost of the sugar program in that year because of (1) obligations on the 1937 crop which could not be paid until the fiscal year 1939; and (2) unexpected obligations to producers arising from the production of record crops of beets and cane in the continental producing areas. Consequently, on May 2, 1939, Congress made available for the fiscal year 1939 an additional $6,500,000 in the Second Deficiency Appropriation Act, of which $5,000,000 was a direct appropriation and $1,500,000 was reappropriated from the unexpended balance of the 1938 appropriation. Therefore, the total amount available during the fiscal year was $54,500,000, and the total obligations to be met from those funds are estimated at approximately $53,945,000.

The foregoing expenses are more than offset by the collection into the United States Treasury, pursuant to the provisions of title IV of the Sugar Act, of excise and import compensating taxes on sugar amounting to $68,769,300 in the fiscal year 1939.

The policy adopted at the inception of the sugar program of utilizing wherever feasible existing governmental agencies to administer the Sugar Act instead of setting up new units was continued during the last fiscal year. The personnel of the Sugar Division consists of a small administrative staff who are responsible for the conduct of investigations, for formulating the necessary findings for approval of the Secretary, and for issuing instructions for field officers. At the close of the fiscal year it had an administrative and clerical staff of 40 employees. The field work for the conditional payment program has been carried on in continental United States and in Puerto Rico and Hawaii by the Agricultural Adjustment Administration. The total administrative expense, except for the expenditures in county offices which are borne pro rata by the producers, was about 1.3 percent of the total cost of the sugar program.

All the administrative work in the field connected with the quota system has been handled by the Bureau of Customs. Other agencies which assist the Sugar Division in its work are the office of the Solicitor for all legal work and conduct of public hearings required by the act, the Office of Information, the Bureau of Agricultural Economics, and the Office of the Treasurer and Division of Disbursement in the Treasury Department.

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REPORT OF THE CHIEF OF THE WEATHER BUREAU, 1939

UNITED STATES DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
Washington, D. C., September 29, 1939.

Hon. HENRY A. WALLACE,
Secretary of Agriculture.

DEAR MR. SECRETARY: I submit herewith a report of the work of the Weather Bureau for the fiscal year ended June 30, 1939.

Sincerely yours,

F. W. REICHELDERFER, *Chief.*

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INTRODUCTION

In his introductions to recent annual reports, the late W. R. Gregg,[1] as Chief of the Weather Bureau, stressed the importance of weather service in modern business and professional activities. He pointed out the need for expansion of the Bureau, and for certain changes to enable it to put "first things first" in weather service. Some of the necessary changes have been accomplished.

The process of adapting the weather service to its changing environment is obviously a more or less continuous one. Like other applied sciences, the science of weather forecasting is profoundly affected by developments in kindred fields as well as in meteorology. Aeronautics and radio communication have opened to the meteorologist new possibilities and new responsibilities. Agricultural planning, forest-, soil-, and water-conservation programs, and flood-

[1] Dr. Gregg's untimely death on September 15, 1938, left vacant the office of Chief of the Weather Bureau. C. C. Clark, Assistant Chief, served as Acting Chief until December 15, 1938, when the present Chief was appointed.

control projects all make new demands upon meteorology, and these demands must be met if the programs are to be successful. Faced with increasing requirements, it is necessary for the Bureau to re-examine the entire weather service and appraise the relative importance of each activity. Newer and more pressing activities may have to replace those which have decreased in importance through developments in recent years. Attention has been directed during the past year to reorganization which will accomplish these changes in an orderly and progressive manner. Continuation of this process is one of the most important tasks for the coming fiscal year.

Climatology, long an important branch of the Bureau's work, has become more important in its application to present-day social and economic conditions. Comparatively minor variations in climate have changed the occupations and curtailed the means of livelihood of thousands of citizens. It is necessary to know as much as possible about the character of climatic changes now in progress and future trends therein. The study of microclimatology has assumed great practical importance in some occupations and professions, notably in agricultural economics, hydrologic engineering, and soil conservation. The Weather Bureau is extending its network of climatological stations as rapidly as possible to meet these modern requirements.

Plans for the current year call also for extension of the Bureau's river and flood warning service; and for amplification of forecasts of weather conditions which relate to forest fires. The fire-weather forecasts greatly assist the Forest Service and other agencies in taking preventative measures. In order to provide more specific weather forecasts for the general public, new forecast districts are being organized from portions of some of the larger districts. The smaller districts enable the forecasters to give more attention to local variations in weather. Further steps are being taken in cooperation with vessel weather observers to develop the ocean weather-reporting system, a program important in the service of storm and hurricane warnings for our coasts.

Ocean weather reports have taken on new importance with the establishment of regular schedules of transocean aircraft. During the last decade or two much progress has been made in international cooperation in meteorology. The science receives further impetus from extension of the various national weather reporting systems to cover additional significant areas of the globe in the interest of air transport. Meteorology is an international science; our weather is determined by air-mass characteristics which originate over other continents or distant oceans. Daily exchange of weather reports among the nations is essential to forecasting of weather and is the basis for research directed towards more complete understanding of storm development and behavior. If international exchange of weather reports is to serve its purpose, the meteorological procedure and practice among nations must be standardized and coordinated, and all observations and reports must be comparable and prompt. Each country, therefore, needs a national weather organization with a comprehensive and unified system of observing and reporting stations to furnish synoptic reports and disseminate its weather information in conformity with standard and uniform times and methods.

Improvements which will facilitate essential exchange of observations have recently been adopted in the weather code used by the Bureau.

In the current appropriation, provision is made for a large increase in aerological observations. These should result in further progress in physical methods of weather analysis and forecasting. Recent technique in air-mass analysis has been introduced at certain of the district centers and is being extended throughout the service as rapidly as possible. The current appropriation also provides for the first unit of a new central office building to house the Bureau's administrative activities in Washington. Administrative offices are now scattered among four widely separated buildings. The present main central office structure, erected as a residence more than 50 years ago, was not designed for office use and is poorly adapted therefor. The new building, authorized after many unsuccessful attempts to obtain funds in past years, will greatly facilitate administrative work.

Much attention has been given during the past year to research and in-service training. These two are closely related and must proceed together. The training program deserves emphasis. Recent advances in meteorology have made it necessary to provide refresher courses for many in the profession. Moreover, since the growing requirements of agriculture, aviation, business, commerce, and other occupational and professional pursuits have increased the volume of work beyond the capacity of present staffs at our city offices and airport stations, a shortage of trained personnel exists. Provision has therefore been made for widespread in-service training and for encouragement of meteorological education and research in universities in various parts of the country.

Some of the advances in the science of meteorology during the past year are briefly reviewed in one of the following sections. Progress in meteorological research has often appeared relatively slow and the results have sometimes been disappointing. In the atmosphere we have to deal with vast and complex physical processes which are difficult to analyze. The development of greater precision in weather forecasting and extension of forecasts to cover a longer time-range are possible only through research. More thorough understanding is necessary with reference to atmospheric circulation and the interaction of air masses underlying various weather conditions. If we recall the success attained in other scientific fields in which research efforts have been persistent and competent, we have reason to expect that similar research efforts in meteorology will yield great benefits. There are few human activities which can boast complete indifference to weather, present or future.

AEROLOGICAL OBSERVATIONS

RADIOSONDE[2] OBSERVATIONS

The steady improvement in the development of radiosondes has resulted in the establishment by the Weather Bureau of six stations where scheduled observations were made daily during the fiscal year.

[2] A radiosonde is a radiometeorograph, an instrument which is sent aloft by a small balloon and which transmits a radio signal indicating pressures, temperatures, and humidities in the upper air.

In addition, the Bureau continued in operation six airplane observation stations. Arrangements were made for the purchase of radiosonde equipment for use on two Coast Guard cutters engaged in international ice-patrol duty off the Grand Banks of Newfoundland. These observations were made daily from March through June 1939. Through cooperative arrangements between the Weather Bureau, Harvard University, and Massachusetts Institute of Technology, daily radiosonde observations were made from March through June at Cambridge, Mass., and St. Georges, Bermuda. These reports and those of the Coast Guard vessels referred to above were transmitted promptly by radio to the Weather Bureau, where they were used in its regular forecast work. These records, together with radiosonde records from the Azores, Iceland, and the French S. S. *Carimare*, stationed in the Atlantic, will provide valuable data for research problems to be undertaken in meteorological conditions over the Atlantic, where upper-air data have been so meager.

Special sounding-balloon observations were made during the period August to November 1938 at seven southern Weather Bureau stations during the passage of tropical storms. A study and analysis of these records will be made.

During April, the international month for 1939, special sounding-balloon observations were made at Omaha. These data will be furnished the International Aerological Commission and published by that organization together with similar data from other countries for studies of world-wide meteorological problems.

Arrangements were made with the Pan American Airways, Inc., to carry an aerometeorograph on their trans-Atlantic and trans-Pacific planes to obtain records of temperature, humidity, and pressure at the flying levels, together with eye observations of significant conditions encountered. In this connection the aerometeorographs formerly used in airplane observations are to be fitted with strip charts that provide for a 24-hour record.

PILOT-BALLOON OBSERVATIONS

Pilot-balloon observations, by which upper-air winds are measured, were inaugurated at 23 additional stations, including Anchorage, Alaska, bringing the total number of pilot-balloon stations to 102. The use of larger (100-gram) pilot balloons, capable of ascending to heights of 20 kilometers or more, was adopted at 23 additional stations. Nine of these stations are located in the Southeast, where a knowledge of the wind data at high altitudes has been found to be of great assistance in forecasting the movement of hurricanes. Helium was substituted for hydrogen in the inflation of observational balloons at about one-third of the stations making such observations. Because the use of helium for this purpose completely eliminates the explosion hazard associated with hydrogen, arrangements were made to extend the use of helium to nearly all balloon stations during the fiscal year 1940. Special balloon theodolites were purchased for "tail-method" observations. Such observations involve the angular measurements of tails attached to the balloons used in wind-aloft measurements and indicate variations in the assumed ascensional rate of such balloons caused by vertical currents in the

atmosphere. Such variations in the assumed ascensional rates result in erroneous values of wind direction and velocity, unless they are actually measured by some method such as this. With the assistance of the Works Progress Administration, all upper-air wind records, involving about 1 million observations, were reduced to punch cards, and arrangements made whereby all future observations of this nature would be so recorded by the Weather Bureau.

SERVICE IN AID OF AIR NAVIGATION

New airport stations rendering 24-hour service and taking 4 pilot-balloon observations a day were established at 20 air terminals, providing a better network of such stations over the country and permitting pilots and others to consult more frequently with qualified Weather Bureau personnel concerning meteorological conditions while en route over the civil airways.

Several new off-airway stations reporting each 6 hours were established to fill in gaps in the previous network of such reports.

About 60 airway hourly reporting stations were equipped with mercurial barometers for the more accurate rendering of barometric pressures and particularly of altimeter settings for the use of airmen in determining their heights above the ground. Similarly, work was continued on the modernization of instrumental equipment at all types of stations, large numbers of these being supplied with new concentrated-beam ceiling projectors, open-scale barographs, eight-point wind indicators, improved temperature- and dewpoint-measuring equipment, etc.

A considerable number of reporting stations were established on new airways during the year.

A new edition (fourth) of Circular N, Instructions for Airway Meteorological Service, was prepared and issued. This publication contains complete instructions regarding the taking and transmission of airway weather reports, transmission of pilot-balloon and radiosonde reports, preparation of forms and forecasts, instructions for inspectional work, installation and care of instruments, etc. To facilitate future revisions that may become necessary, the circular has been issued to Weather Bureau stations and others closely connected with airway meteorological work in loose-leaf form.

There are 720 points in the continental United States at which observations are made for or utilized in the airway meteorological service. The principal classifications of these stations according to personnel, facilities and service rendered are given below. It will be noted that the total number of stations in the classifications is greater than the total number of reporting points given above. This is because many stations fall into several clasifications. For example, all stations in paragraphs (1) and (2) are also teletype stations and are included in paragraph (3); likewise, many stations in paragraphs (1), (2), and (3) are also included in paragraph (4).

(1) There are 88 stations located at airports manned completely by a staff of civil-service Weather Bureau employees, rendering 24 hours of service daily, where hourly or more frequent weather reports are received and transmitted by teletype, weather maps are prepared

every 6 hours, and all information, including airway forecasts and upper-air pilot-balloon and radiosonde reports, are posted for the information of pilots and other aviation interests concerned. Trained personnel are available at all times to discuss with and advise pilots and others of present and probable future weather conditions along the airways.

(2) Thirty stations are manned by one civil-service Weather Bureau employee and three noncivil-service airway observers. These stations are in a position to render service similar to that of stations described in paragraph (1) except that only one (in some cases two) weather map is prepared daily and the trained civil-service employee is available for consultation and advice only during his tour of duty, which consists of 8 hours a day, 5 days a week.

(3) Three hundred and fifty-three of the stations are equipped with teletype and send and receive hourly or more frequent weather reports.

(4) One hundred and seventy-one stations transmit by teletype every 6 hours (1:30 and 7:30 a. m. and p. m.) data, in addition to that transmitted at other hours, for the preparation of weather maps. These additional data include the 3-hourly pressure change and characteristic, the kind, height, and direction of clouds, the time, character, and amount of precipitation, thunderstorms, 5,000-foot pressures, maximum wind velocity and direction, maximum and minimum temperatures, and snow on ground.

(5) One hundred and sixty-five stations are located on the airways but are not equipped with teletype facilities. They are manned by part-time airway observers, who telegraph reports at definite times, or when called on to do so, to designated centers for the clearance of scheduled airplane flights.

(6) There are 132 stations located off the airways, manned by part-time airway observers, except in a few places where Weather Bureau city offices are located, which telegraph complete 6-hourly reports at 1:30 and 7:30, a. m. and p. m., for map purposes. The reports are telegraphed to designated centers, where they are placed on the Civil Aeronautics Authority teletype circuits for national distribution to all airport and map-making stations.

(7) Twenty-five of the stations mentioned in paragraph (6) are selected to forward reports every 3 hours to enable forecasters to keep track of weather trends and developments between their 6-hour map and forecast periods.

(8) Eleven stations are designated as airway general-supervising stations and forecast centers. These stations, which have general supervision over their respective districts and prepare all forecasts for the airways and terminal landing points within the district, are located at Newark, N. J., Arlington, Va., Atlanta, Ga., Cleveland, Ohio, Chicago, Ill., Kansas City, Mo., Fort Worth, Texas, Salt Lake City, Utah, Seattle, Wash., Oakland, Calif., and Burbank, Calif.

The Weather Bureau airport and general-supervising station formerly at Portland, Oreg., was transferred to Seattle, Wash., thus permitting more efficient use of teletype and radio circuits and the furnishing of more adequate service to the new Seattle-Alaska, the northern transcontinental, and the Pacific-coast airlines, all of which terminate in Seattle.

In addition to the above, the Bureau maintains approximately 100 stations in Alaska and Hawaii, from which reports are obtained and service rendered to the aviation interests in these localities. Numerous reports are also received from Canada and Mexico and from ships in the Atlantic and Pacific Oceans, the Gulf of Mexico, and the Caribbean Sea.

CLIMATE AND CROP WEATHER DIVISION

The Climate and Crop Weather Division continued to render service to widespread and diversified interests. Special reports were issued from time to time on the status of the weather conditions, with special emphasis upon droughts. The demand for certified reports for court use continued to be heavy; approximately 600 such certifications were issued. In addition to this, some 2,000 inquiries relating to the climate of the United States and other countries were answered by mail from the central office alone during the year.

The climatological service with its 5,000 cooperative observers and 45 section centers maintained its regular activities. Records totaling nearly 2 million daily observations were printed and distributed within approximately 1 month after receipt of form reports. In addition to these, Form 1030, or the Monthly Meteorological Summary, was issued at approximately 150 first-order offices to furnish weather data promptly at the close of each month. Station annual summaries for 1938, with comparative data, were issued for 65 stations.

Collection of data by means of Forms 1001 and 1001A continued, marking the completion of the sixty-ninth year of detailed meteorological records for the entire country. Cooperation was maintained with other agencies, particularly the engineers of the War Department, in furnishing past records of precipitation. A very essential need of the Bureau was met by preparing and publishing a set of definitions and descriptions of hydrometeors.

The fruit-frost service was maintained at its usual efficiency. Warnings issued in the field by the fruit-frost personnel were instrumental in saving a large proportion of the citrus crop in California during the serious freeze of November 1938. In some sections of California frost damage was considerable, but in others, through timely warnings, the bulk of the crop was saved. The citrus industry produces an annual crop valued at 35 to 40 million dollars, and the savings from frost damage through timely warnings average more than the total appropriation for the Weather Bureau. In addition to those in California, similar warnings were issued in Florida, Texas, and Arizona, and in the apple- and pear-growing districts of the Pacific Northwest.

The collection and dissemination of data on the weather-crop relationship were continued, with 44 section centers publishing weekly reports for their respective sections on the effect of the prevailing weather on crops and farming operations. These State reports are widely distributed and furnish a comprehensive summary of current information. In a number of States close cooperation is maintained with the Bureau of Agricultural Economics' crop-reporting service, and a joint report is prepared for release. Summaries of these

weather-crop publications are telegraphed to Washington every Tuesday for inclusion in the Weekly Weather and Crop Bulletin, which affords a Nation-wide survey of the effect of weather on crop conditions from week to week and in addition contains current, pertinent information on droughts or other adverse weather conditions.

The corn-and-wheat-region and cotton-region services continued in operation. These furnish daily reports on temperature and rainfall throughout the important grain- and cotton-producing areas of the country. The issuance of these daily reports gives all who are interested an accurate, timely picture of current weather.

RECENT WEATHER TRENDS

Because of the recent successive drought years and a longer time persistence of abnormally high temperatures, many people are asking, "Is our climate changing?" During the present decade there has been a decided tendency to dry weather and for more than two decades to abnormal warmth, notwithstanding an occasional bad flood or a severely cold winter. Considering the country as a whole, the winter seasons, with the exception of those of 1917–18 and 1935–36, have been rather uniformly warmer than normal for the past quarter of a century, and, on an annual basis, every year of the last decade has had above-normal temperature. Also, in the matter of rainfall, there has been an equally marked tendency to droughts in recent years. However, an examination of the longer weather records of the country, going back 100 years or more, indicates that this does not represent a permanent change of climate, but rather a warm, dry phase of our normal climate, to be followed by a cooler, wetter phase, when there will be more rainfall and lower temperatures.

The situation may be described in this way: We have weather and we have climate. Weather refers to conditions for a day, a week, or even a year. We say, for example, that last week was wet or dry, cold or warm, as the case may be. Climate is the average weather (temperature, rainfall, etc.) over a very long period of years, for the purpose of comparison, say, 100 years. We know that weather from day to day and week to week frequently has a more or less cyclic tendency, that is, a few cool or cold days are succeeded by several days of warmer weather, and frequently a few days of rain by fair, sunny weather for a short period. The same thing applies broadly to climate, the difference being that we count the time in periods of years instead of days. It is important to remember that these climatic cycles vary in length, just as do the weather cycles, resulting in some periods of light rainfall, or droughts, lasting longer than others.

Climate presupposes the existence of records of sufficient length to determine the general run of weather, and consequently the value of a record for such purpose increases with the length of time it represents. Therefore, a record covering only a few years, say up to 10, has little value in climatic studies of this character for that particular period may not represent the basic climatic characteristics of the locality. If records for our Midwest were available only for the last 10 years, an appraisal of its climate based on this period would be very misleading.

Of the various aspects of historical climate, the question of long-time tendencies, or trends, is one of the most, if not the most, important. The present warm, dry phase has been typified during the present decade by three Nation-wide, destructive droughts, 1930, 1934, and 1936, and by a general warmth not exceeded for a century.

An examination of past records covering many years, some of them more than a century, discloses certain characteristics and interesting features of these long-time trends in precipitation and temperature. The cycles of precipitation, if we may call them such, usually are shorter and less extensive geographically for a given phase than those of temperature. For a good many years past, and until recently, there has been a marked downward trend in precipitation over the Northwest and much of the West, and to somewhat less extent in central districts, while in much of the South the trend, in general, was upward. These trends in moisture have great economic significance, especially with regard to agriculture. The importance of the shortage in moisture resulting from the markedly subnormal rainfall is well illustrated by stating that for the Dakotas alone the shortage in water, as compared with the normal rainfall, was nearly 3,000 tons per acre of land for the period from 1930 through 1936.

In the case of temperature there has been a much more systematic and extensive upward trend since the turn of the century, not confined to any group of States, nor the United States, but in evidence throughout the world. Examples for widely scattered localities for the last two decades may be cited: Portland, Oreg.—17 of the 20 years warmer than normal; the warmest year of record, 1921; every year since 1922 above normal; Omaha, Nebr.—15 years warmer than normal; warmest of record, 1931; Washington, D. C.—17 years warmer than normal; warmest of record, 1921; every year above normal since 1926; Capetown, South Africa—19 years warmer than normal; warmest of record, 1927. Summaries of monthly records published in the Reseau Mondial for the 23 years 1910–32 for which this publication is available, show that for this period the world as a whole had subnormal temperature in only a year or two, approximately normal for a couple of years, and considerably above normal in all other years. Some long records indicate that an extended period of abnormal warmth prevailed about the beginning of the nineteenth century, but that for an intermediate period, more pronounced from about 1855 to 1877, the general run of temperature in the United States was as much below normal as the last quarter of a century has been above normal. This indicates that the present warm, dry trend may similarly be a temporary phase.

THE WEATHER OF 1939

Following a summer of relatively high temperatures with mostly adequate rainfall, ranging from near normal to decidedly above normal in nearly all sections of the country, the fall months of 1938 continued abnormally warm. Rainfall was heavy in the Rocky Mountain and Great Basin areas and also in most of the more eastern States, but much of the interior was decidedly dry. At the beginning of the winter soil moisture was ample over most of the

eastern half of the country, except for considerable areas in the South.

THE WINTER OF 1938–39

The winter of 1938–39 was characterized by continued abnormally warm weather, a condition markedly in evidence during the winter seasons of the past quarter of a century or more. The lowest temperature reported was −51° F., at Meadowlands, Minn., on February 21. The lowest observed in Alaska was −60°, at Fort Yukon on February 7. Moisture was generally abundant the latter part of the season except in limited areas in the Northwest. In December precipitation was scanty throughout nearly the entire country, being markedly deficient in the Great Plains, where the monthly totals ranged from only about 25 percent of normal in Kansas to a little more than half the normal in North Dakota. However, after January 1 precipitation became more abundant and the winter culminated in one of the wettest Februarys of record. This month broke all previous February records for heavy rainfall in a large part of the Southeast. For the winter as a whole precipitation was above normal in the southern Rocky Mountain States, on the west Gulf Coast, and everywhere east of the Mississippi River, Florida excepted.

THE SPRING OF 1939

The spring (March–May) was warmer than normal throughout the country except in a limited area from the upper Lake Region eastward. March was relatively dry in much of the Midwest, and April decidedly so in the Great Plains, the Rocky Mountain States, and the Pacific Northwest. Because of continued scanty rainfall, severe drought conditions had developed over a large western area by the middle of May. The lack of moisture was intensified by high temperatures, and the need for rain became pronounced from central Kansas and Missouri northward and northwestward to the Canadian border. Another major drought year appeared to be in the offing, but the latter part of May brought generous and extensive rains to most Midwest sections, which effectively relieved droughty conditions and revived vegetation enormously. Some southwestern sections, including most of New Mexico and Arizona, continued unfavorably dry.

The Midwest spring dryness was in marked contrast to the spring of 1938, when rains were heavy over most of the country. There was less rainfall during the spring months than in the spring of 1936, a severe drought year, in Colorado, New Mexico, Texas, Kansas, Nebraska, South Dakota, and Minnesota, but in other Midwest States there was somewhat more moisture than in the spring of 1936. In review, the winter had mostly abundant rainfall, but in early spring the amounts became scanty in the northern Great Plains, and droughty conditions spread from there southward and eastward until by the middle of May nearly the entire interior of the country was needing rain badly.

For the first half of the year (January–June) precipitation was about normal to considerably above normal in all States from the Mississippi Valley eastward. The region from the Ohio Valley southward had the largest excesses. However in the western half

of the country, all States, except Montana, had deficient precipitation, the relatively driest State being California, with only 64 percent of normal precipitation.

THE SUMMER OF 1939

June had abundant rains except in the Southwest, where a considerable area continued dry, including principally Colorado, New Mexico, and Arizona. In an area between the Mississippi River and Rocky Mountains the June rainfall was timely, substantial, and very beneficial to growing crops. The amounts were especially abundant in the northern Great Plains, with Montana receiving nearly one and one-half times the normal. Temperatures continued to range generally above normal.

In July a serious drought developed in the Northeastern States, unfavorably affecting an area from New Jersey and Pennsylvania northeastward. Some sections had the greatest July rainfall deficiency in half a century up to nearly the close of the month, when there were intermittent showers on several days. However, these were decidedly local in character and irregular in amount, in some cases being heavy and in others not enough to be of material benefit. Early in August additional rains occurred over most of the northeastern area. However, an urgent need for rain continued over a large southwestern section and also throughout the Great Plains from North Dakota to the Rio Grande. Most other interior States had sufficient moisture for current crop needs.

The summer (June–August) was characterized by abnormal warmth in all areas and markedly deficient rainfall over large western sections, especially from the western plains westward. Colorado had the greatest deficiency in moisture, with average rainfall for the 3 months only half the normal. However, from the Mississippi Valley eastward the summer totals were uniformly above normal, except in the Northeast from Pennsylvania and New Jersey northward. New York had only about three-fourths of normal rainfall for the season. Alabama, with one and one-half times the normal, was the wettest State.

FIRE-DANGER-RATING FORECASTS

Marked progress has been made in further adaptation of fire-weather-forecasting procedure to the peculiar needs of forest-protection agencies. The newly developed forecast terminology has enabled forestry officials using the forecasts to be certain that they understand the forecaster's exact meaning. A significant forward step was taken in the use of fire-weather forecasts in specifically determining the degree of prevention and suppression effort required to handle fire situations developing out of predicted weather conditions.

As a result of the extensive damage to forests in New England by the destructive winds in the storm of September 1938, the fire-weather service in that region has been considerably strengthened. In addition to this a cooperative program between the Weather Bureau and the Forest Service has been inaugurated which extends the latter agency's fire-danger-rating activities to include predictions of fire-danger levels for 24 or more hours in advance. Fire danger is

rated on a simple numerical scale that is definitely linked with, and translatable into, prevention action and strength of force which must be held in readiness to handle anticipated fire business. Prior to this all such rating practice has been confined to the determination of danger conditions for the current day. However, wind damage to New England forests brought about a marked increase in the likelihood of serious fire outbreaks, and it became evident that actual predictions of fire danger as well as of weather occurrences would be of great assistance under such extraordinary circumstances.

To accomplish this, close cooperation between the Weather Bureau and the Forest Service was necessary, involving coordination of the efforts and facilities of the two agencies in New England. Detailed reports from Forest Service fire-danger stations are sent to the Weather Bureau office in Boston to supplement the meteorological observations regularly used in the fire-weather work. A Forest Service official is assigned to assist the fire-weather forecaster in analyzing this mass of information both from the fire-danger and fire-weather standpoints. After a thorough study has been made, a forecast is issued to cover conditions during the ensuing 24 to 48 hours. Finally, by integrating the predicted values of weather elements and measured fuel-moisture contents, a forecast of tomorrow's class of fire danger is made. Both predictions are given joint distribution throughout New England, together with an analysis of prevailing weather and fire-danger conditions by telephone, telegraph, and scheduled broadcast from numerous radio stations.

RADIO MICROPHONES IN WEATHER BUREAU OFFICES

Radio broadcasting ranks high as a means for disseminating weather forecasts and warnings. At present more than 500 broadcasting stations are cooperating with the Weather Bureau in this work. From each of them local and State forecasts are given out on fixed schedules from one to five times a day, and special broadcasts of warnings of cold waves, storms, frosts, floods, etc., are made whenever such warnings are issued. For the most part forecasts are supplied to broadcasting stations by telegraph and telephone; in some cases other means are employed. Difficulties often arise that result in broadcasting stations not receiving the latest forecasts or in erroneous interpretations of the predictions being announced. Much of this difficulty is being overcome by installing in Weather Bureau offices microphones directly connected by wire with the broadcasting stations. The forecasts and synopses are given by Bureau employees in person, thus controlling responsibility for what is broadcast. Microphones are now in 36 Bureau offices, and this number is steadily increasing. The microphones are furnished and installed by the broadcasting companies as a public service.

Direct radio announcements from Weather Bureau offices will have an important part in the new program of four maps and forecasts a day. Heretofore, it has been impossible to provide in the early morning fresh and detailed forecasts of weather for the remainder of the day because those announced by radio or published in the morning paper were predicated on observations taken 10 or more hours before. The new program will provide for four forecasts

a day in contrast with the present two. The early-morning forecasts now being made available are based on observations taken at 1:30 a. m., eastern standard time. These forecasts will come to business people by radio before they leave home for their offices and may be termed "breakfast-table" forecasts. Thus, people engaged in industries that are affected by weather can plan their work in the light of the latest weather information instead of having to depend on information many hours old or wait several hours for a prediction.

WEATHER OBSERVATIONS FROM COAST GUARD STATIONS

Cooperation between the Weather Bureau and the Coast Guard in the taking of observations was materially extended during 1938 to include the furnishing of complete observational data at 6-hour intervals from selected Coast Guard stations between eastern Long Island and Cape Hatteras.

A complete equipment of meteorological instruments was installed at 11 coastal stations, and instruction was given to personnel at these stations in observational techniques. The observations which are transmitted in numeral code are collected at central points through Coast Guard facilities and made available for use in the airway and general service work of the Bureau. These reports are of especial value in connection with trans-Atlantic flying and the issuing of storm warnings.

RIVER AND FLOOD SERVICE

The reorganization and expansion of the river and flood service, which is responsible for the prediction of flood and navigation stages in the rivers of the United States, has continued to progress in its three-fold program: (1) Refinement and expansion of the observation and reporting system of effective rainfall in upstream basins of major drainage areas; (2) hydrometeorological analysis of rainfall for use by the Army and Department of Agriculture in the design of flood-control works; (3) expansion of the mountain-snowfall service in the West. In addition, a winter-sports bulletin was inaugurated during the winter of 1938–39 for the benefit of the increasing number of skiers and other winter sports enthusiasts who have need for current information on snow conditions and related weather forecasts.

The flood forecasts issued by the Weather Bureau are of proven economic value. In addition to minimizing or preventing the loss of human life by providing opportunity for evacuating threatened areas, the advance flood predictions enable manufacturers and warehousemen to remove perishable goods; such forecasts also provide essential warnings for the safeguarding of navigation and the construction and operation of emergency protective works.

In order to maintain the flood-warning service at the greatest possible efficiency under existing appropriations, the River and Flood Division endeavors to extend its facilities into new areas and to improve forecasting methods through research. Research has progressed along two lines: (1) Hydrometeorological studies conducted in cooperation with the Corps of Engineers of the Army and the conservancy agencies of the Department for the purpose of deter-

mining, by hydrometeorological methods involving air-mass analysis and transposition of storms, the maximum flood-producing characteristics of regions in which there are flood-control projects; (2) rainfall run-off studies conducted at the hydrologic regional centers of the River and Flood Division. These studies systematically attack the problem of determining river stages from rainfall data, which thus become the basis of flood-forecasting procedure in headwater and tributary basins. The older method of forecasting by gage relationships is not adequate for present-day needs, especially in headwater areas, where periods of concentration are short. It is in these headwater areas, however, that flash floods occur, often with destructive effects far out of proportion to the size of the streams involved.

The flood-forecasting service in Pennsylvania has now been consolidated on a cooperative basis with the Commonwealth of Pennsylvania and the United States Geological Survey and is designated as a Federal-State forecasting service. In Pittsburgh, a W. P. A. project has been established for the preparation of river-basin maps on which are shown all rainfall and river stations.

The expansion in winter sports in recent years not only represents an expansion in national recreational facilities but has resulted in their becoming a business of major proportions. To meet this new demand, the Weather Bureau has engaged selected observers in winter-sports areas to send weekly reports on snow conditions to regional centers, where they are consolidated and disseminated by press and radio, together with special winter-sports weather forecasts for the week end. The winter-sports reporting and forecast service was confined last winter to the northeastern United States and the Southwest, but it is planned to extend the program into the other sections of the country in the near future.

PROGRESS IN MARINE METEOROLOGY

REVISION OF THE PILOT CHARTS

For the first time in more than 25 years the weather information on the pilot charts is undergoing a thorough revision. The charts were founded on the researches begun by M. F. Maury, an American naval officer, nearly 100 years ago. Millions of ships' weather observations, which have accumulated in the files of the Weather Bureau, have been compiled and summarized to provide new data for wind roses to 16 compass points, the fog and gale frequencies, and average wind and weather conditions. Publication of the revised material for the North Pacific Ocean began with the issue of January 1939. Similar revisions are planned for other oceans. The meteorological information on the pilot charts is widely used by ships of all nationalities.

NEW CLIMATIC ATLAS OF THE OCEANS

The Atlas of Climatic Charts of the Oceans, based on 5½ million observations from ships at sea, has been printed and distributed. A description of material in this Atlas has been included in previous reports. It is of practical importance especially to maritime navigation, transoceanic aviation, and world climatology.

CHARTING OF SEA SWELLS

In 1938 several nations cooperated in a study of sea swells on the North Atlantic Ocean. The survey was organized and carried out for the period November 14–19. The Weather Bureau took part and was assisted by the Hydrographic Office, the Coast Guard, and the Bureau of Lighthouses. A large number of special observations from ships and coastal stations was obtained in the survey; they were assembled by an International Subcommission for the Study of Sea Swell. Arrangements are being made for an analysis of the data and for the preparation of synoptic charts of swell and related elements. The results are expected to be of importance in forecasting the arrival of sea swells in localities where they are sometimes dangerous to shipping.

TEMPERATURES OF THE OCEAN SURFACE

An investigation dealing with temperatures of the ocean surface was completed, and the results were published. This study covered the western North Atlantic Ocean, including the Caribbean Sea and the Gulf of Mexico. Normal surface temperatures were determined by months for each 1° square from data collected during the 20-year period 1912–31. A summary with 16 charts was published in the Monthly Weather Review, February 1939, and was also distributed as a separate. The charts are intended primarily as an aid in weather forecasting but are also of practical value in air-conditioning of ships' cargoes and for other commercial purposes.

THE "EYE OF THE STORM"

In a special study of the calm center, or "eye," of the tropical cyclone, completed during the year, it was found that although there is considerable uniformity in the meteorological and sea conditions in the center of tropical cyclones, nevertheless there are occasional wide variations, as for instance, in the state of the sea, which, generally described as tumultuous, is occasionally smooth or only slightly confused. The results of the study, which are of special value to maritime interests, have been made available in manuscript form for publication on the Pilot Charts of the Hydrographic Office as a contribution from the Weather Bureau.

WORK IN PROGRESS

A detailed study has been begun of fog in restricted portions of the North Atlantic Ocean where fogs occur an appreciable percentage of the time, with special reference to the great North Atlantic steamer lanes. It is contemplated that this study will give: The normal distribution of fog for each month, on a 1°-square basis; the wind directions most frequently associated with fog for each 5° square; and historical compilations of variations in fogginess for a few representative areas.

Efforts were continued, as in previous years, to improve barometry on shipboard. As one result, during the year, shipmasters and shipowners replaced, at their own expense, defective and erratic barometers on 44 ships. In order to obtain greater accuracy in

barometer readings, a special investigation was made in the reaction of aneroid barometers to temperature and pressure changes, and a system of variable corrections was inaugurated for reporting ships on the Pacific Ocean. As a further aid in enlisting the interest of the mariner in accuracy of barometer readings and in the preparation of weather maps on shipboard, a special article entitled "Technique of Drawing Isobars on Weather Maps" was prepared and published on the Pilot Charts. Improvement in barometry on shipboard is needed for accurate weather forecasting and as an aid to safety of navigation.

CLOUDS

Clouds are of great interest to the layman as well as to the weather forecaster. Publications of the Bureau on cloud forms and codes were revised to conform to the new cloud definitions and descriptions in the International Atlas of Clouds and States of the Sky. Three publications were printed and distributed. The first is a sheet with 20 selected cloud pictures and abridged definitions for the convenience of observers in identifying cloud forms. The second is a booklet of 24 pages containing 32 selected pictures and complete definitions and descriptions. The third deals especially with cloud codes; it is intended primarily for the use of observers, contains 100 pages, including 70 selected pictures, and presents in detail the code specifications for synoptic messages. Cloud publications are quite necessary in securing accurate observations for weather-map analysis and forecasting.

INTERNATIONAL CONFERENCES

Representatives of the Weather Bureau took part in two meteorological conferences in which meteorologists of many countries participated. A conference of Regional Commission III (South America) was held at Montevideo, Uruguay, in February 1939. While membership in this commission is confined to directors of meteorological services in South America, many of the problems discussed were of mutual interest to the services of both North America and South America; consequently the Weather Bureau sent a representative in compliance with the request of the Commission. As a result of the conference, the cooperative relations between the weather services of the two continents were enhanced, and special progress was made in planning for more adequate reporting from ocean areas and for improved meteorological protection for aircraft.

International conferences held in Berlin, Germany, in June 1939, were attended by two representatives from the Weather Bureau. The biennial meeting of the International Meteorological Committee followed sessions of the Commissions on Maritime Meteorology, Aeronautical Meteorology, and Aerology. Subjects for discussion and coordination included meteorological protection for aviation on long-distance flights and ships' weather reporting in connection with transoceanic service. A special conference of representatives of the Weather Bureau, Civil Aeronautics Authority, and European meteorological services, made preliminary plans for an extended system of rapid exchange of meteorological information between Europe

and North American services four times a day, for the protection of aircraft in flights across the North Atlantic. Standard methods of furnishing weather information were outlined in detail in a new reglement prepared in the Commission for Aeronautical Meteorology. Other important accomplishments included the authorization of an increase in the number of selected ships of all nations for meteorological reports and the draft of new statutes for the International Meteorological Organization, which has voted to hold its next important conference in Washington and Toronto in 1941 for adoption of new statutes and for consideration of many other international problems. The Washington meetings will include the Conference of Directors, held at intervals of 6 years, and a joint conference of regional commissions for North America and South America. This is the first time that international meteorological meetings of this character have been scheduled to be held in North America.

INSTRUMENTAL EQUIPMENT

BAROMETERS

In order to compare the Weather Bureau standard of barometry with those of the Canadian Meteorological Service and the National Bureau of Standards, a high-grade mercurial barometer with 0.6-inch-bore tube was procured in June 1939. After comparisons in the Instrument Division, it was carried by automobile to Toronto, then back to the Instrument Division, and then to the National Bureau of Standards. The investigation is not completed, but it can be stated that the three systems are in agreement within the limits of readings of instruments of this type.

In order to provide mercurial barometers considered especially suitable for use by inspectors, a number of Tuch pattern instruments have been rebuilt. These are expected to be issued shortly.

Twelve ½-inch-bore mercurial barometers procured during the year are now under inspection and calibration. They are intended for installation at stations in various parts of the country so located as to be accessible to inspectors. They will serve as means of reference to make sure that no change beyond allowable tolerance occurs in the inspector's barometer. No departure from the long-established practice of determining corrections for mercurial barometers by comparison with the Instrument Division substandard in Washington is contemplated by this arrangement.

The Weather Bureau standard of barometry is the mean value of the readings of a group of high-grade mercurial barometers that were originally compared with those at Kew Observatory in England and have since been safeguarded and intercompared from time to time during half a century.

A set of precision aneroid barometers is being purchased in the hope that it may serve as an auxiliary means for checking airways barometers. If this method is successful the accuracy of mercurial barometers can be checked in a shorter time by the Weather Bureau airway inspectors than at present.

Development of a fixed-cistern mercurial barometer for station use is in progress. This type can be read more quickly than those of the usual Fortin pattern and possesses advantages in determin-

ing instantaneous values when pumping accompanies high-wind velocities.

CEILING-LIGHT PROJECTORS

In cooperation with the National Bureau of Standards, and the Canadian Meterological Service, there is being developed a new method for determining cloud heights in daytime under conditions of precipitation. Under these conditions the ceiling-balloon method is very inaccurate. The new method consists of interrupting or modulating the light beam projected upon a cloud layer. A light-sensitive clinometer is directed to the projected spot, and the height of the cloud determined by triangulation. In the Weather Bureau the light beam is modulated by electrical means: in the Canadian system it is modulated by mechanical means.

RADIOSONDE

In order to make sure that radiosonde indications are accurate, not only were inspections made at the contractor's factory, but subsequent laboratory and field tests were made by the Bureau. Laboratory checks consist in subjecting the radiosonde to changes of temperature and pressure in the same manner that they occur in an actual sounding, and comparing indications with those of standard instruments. Field checks consisted in attaching to the same balloon carrying the radiosonde three types of recording instruments, which on recovery furnish data for comparing soundings. A method was devised for obtaining slow ascensional rates during the first few kilometers of a sounding so that more accurate values of relative humidity might be obtained. Further development work was done on the radiosonde to improve its performance, especially in rainy weather.

TRANSOCEANIC AEROLOGICAL SOUNDINGS

Experiments have been carried out both on the Atlantic seaboard and the Pacific by placing airplane sounding instruments on trans-ocean aircraft. This use of these instruments presents several problems which it is hoped can be solved during the coming year; for example, exposure of the instrument on the airplane in a way to avoid aerodynamic drag and at the same time obtain an accurate determination of the aerological conditions.

LIBRARY

The Weather Bureau library has the largest collection of meteorological literature in the world. It is extensively used by the technical staff of the central office and by the field stations of the Bureau, as well as by other governmental organizations and private institutions. Of late the demands on the library have increased because of the natural growth of the Weather Bureau service and increasing interest in meteorological research. Nearly 200 periodicals are received, about 50 of which are purchased; the remainder come by exchange with the Monthly Weather Review or are gifts. Many of these periodicals deal solely with meteorology; all contain items of interest for meteorologists. The library also receives by exchange official publications from meteorological services and institutes throughout the world.

Almost every Bureau office, including those at airport stations, requires a small collection of technical works for frequent reference. During the past 3 years the number of volumes in these station libraries has been increased by one-third in an attempt to meet the growing needs of the service.

ADOPTION OF A NUMERAL CODE

Arrangements were perfected to put into operation on July 1, 1939, a numeral code for the transmission of weather observations from meteorological stations located on land. This replaces a code composed of words which was utilized by the Weather Bureau for many years but was not adaptable to international uses. The code is an important factor in modern meteorological services because of the necessity for expeditious exchange of weather data between nations. The numeral code is constructed on principles adopted by the International Meteorological Organization and consists of groups of not more than five figures. As a rule the number of figure groups in a message is not less than five nor more than nine.

Expeditious transmissions, economy, brevity, and accuracy in translating the information, regardless of the country from which an observation emanates, are the objectives of the code, rather than secrecy.

METEOROLOGICAL RESEARCH

Progress in research was achieved in a number of problems covering a wide field in meteorology and its practical applications. The results of research carried on by the Weather Bureau are published as completely as possible in the Monthly Weather Review, which, in addition to its function of promptly disseminating climatological and weather data and reports for public use, also provides limited facilities for the publication of contributions to meteorology.

Among the more important research papers of most general interest that appeared in the Monthly Weather Review may be mentioned the following:

New Values for the Infrared Absorption Coefficient of Atmospheric Water Vapor, by Walter M. Elsasser (vol. 66, p. 175), continuing the investigation of this important problem in meteorological physics, begun last year.

The Determination of Evaporation from Land and Water Surfaces, by C. W. Thornthwaite and Benjamin Holzman (vol. 67, p. 4).

Three papers on synoptic meteorology and air-mass analysis: Frontal Movements Contrary to Indicated Gradient Flow Produced by Minor Waves, by A. K. Showalter (vol. 66, p. 165); The Use of Vertical Cross-Sections in Studying Isentropic Flow, by C. H. Pierce (vol. 66, p. 263), supplementing the paper by H. R. Byers on isentropic charts published on pp. 63–68; and a Practical Method of Computing Winds Aloft from Pressure and Temperature Fields, by Edward M. Vernon and Edward V. Ashburn (vol. 66, p. 267).

Two reports on climatic investigations: Precipitation in the Great Plains, by W. A. Mattice (vol. 66, p. 117), timely summary of climatological data to date for this region; and Climatic Research in the Soil Conservation Service, by C. W. Thornthwaite, Benjamin Holzman, and David I. Blumenstock (vol. 66, p. 351).

Reports on the unprecedented flood-producing rain in southern California: Synoptic Analysis of the Southern California Flood of March 2, 1938, by Charles H. Pierce (vol. 66, p. 135); Southern California Rain and Flood, February 27–March 4, 1938, by Lawrence H. Daingerfield (vol. 66, p. 139); and the usual monthly reports on West Indian tropical disturbances.

A number of manuscripts reporting important investigations were awaiting publication at the close of the year, earlier publication having been prevented by lack of printing funds.

INVESTIGATIONS UNDER THE BANKHEAD-JONES ACT

As a part of the general weather- and crop-forecasting program of the Department of Agriculture, the Weather Bureau continued to conduct, in cooperation with the Bureau of Agricultural Economics and several universities, investigations directed toward a more complete understanding of processes affecting weather changes and the persistence of weather abnormalities, with a view to increasing the range of weather forecasts.

An investigation of the formation of cold waves, which was started in the fiscal year 1937, was brought to a logical completion. The results of upper-air soundings at Fairbanks, Alaska, and their interpretation in relation to terrestrial radiation and snow-surface temperature measurements, are the subjects of comprehensive research reports. The results show that the temperatures, even up to heights of several thousand feet, in the cold air masses of high latitudes in winter are affected by delicate thermal adjustments according to the temperature of the snow surface at the ground and its output of long-wave radiation. Attention was directed toward the problem of the release of these cold air masses, once formed, into the "waves" of intense cold that sweep southward into the United States, especially in its relation to other problems of the general circulation of the atmosphere. In cooperation with the Massachusetts Institute of Technology, under a Bankhead-Jones project centered on the problem of summer weather activity, an integration of the work on winter polar-air invasions and the action of the broad circulation systems of lower latitudes was accomplished. At the same time, in a project in cooperation with the California Institute of Technology the same general methods involved in the study of the cooling of the air overlying the snow surface of the frozen North were applied to the development of "cooling curves" showing, from a given distribution of temperature and water vapor, the rates of cooling or heating at various levels and at various places in the atmosphere.

Three of the most important results that appear to have definite application to longer-period forecasting which have come out of the cooperative research projects with the Massachusetts Institute of Technology and the California Institute of Technology are:

1. The discovery of what appear to be the real factors determining the positions of the warm anticyclones which are the centers of action for the air circulation over the Northern Hemisphere at any given time.

2. The determination of the factors that regulate the displacements of these centers, particularly with respect to the intensity of the west-to-east circulation in middle latitudes, easily observed on ordinary weather charts.

3. The development of modern data concerning radiation and convection into systematic tables and curves of cooling and heating, as mentioned above, producing for the first time concrete detailed information concerning the driving forces of the atmospheric circulation.

In any study centered around long-period atmospheric phenomena the atmosphere of the whole Northern Hemisphere must be the laboratory or proving ground. This is reproduced in miniature on the daily charts of the Northern Hemisphere prepared under a cooperative project with the Massachusetts Institute of Technology, started previously by the Bureau of Agricultural Economics, and taken over this year by the Weather Bureau. Not only were the theories tested by putting them into practice in actual long-range experimental forecasts based on the Northern Hemisphere maps, but also several new clues useful in long-range forecasting were discovered from these charts. The Bureau of Agricultural Economics has cooperated in statistical studies in connection with these charts; and indices based on the observed intensities of the west-to-east, or so-called zonal, circulations have shown great promise.

The study during the previous year of the possibilities of a link between solar activity and meteorological phenomena in the lower atmosphere, brought about through the action of ozone present in the upper atmosphere, justified a modest program of investigation. In cooperation with the University of Rochester, self-recording apparatus for measuring variations in ozone is being developed for field use. New York University is cooperating by furnishing for comparison purposes a Dobson ozone-measuring instrument. It is expected that regular observations will begin soon at Whiteface Mountain, N. Y., to investigate the significant relations between atmospheric ozone content and the weather.

AIR-MASS ANALYSIS

Progress in the development of improved methods of analysis and forecasting of day-to-day weather has continued. Practical acomplishments included the integration of the daily map-analysis work with the map and forecasting procedures at the Bureau's largest forecast center, located in Washington, so that virtually complete practical application of air-mass analysis has been effected. Another accomplishment has been the development of speedy computation methods based on special nomographs for constructing isentropic charts for the use of the forecasters in making their daily predictions. Isentropic charts present the atmospheric flow in a very satisfactory and complete two-dimensional picture and have been recognized as the most practical means of direct representation of upper-air data.

As part of the Bureau's investigational work a detailed study of the New England hurricane of September 1938 was completed; and a special micrometeorological study was made of the winds in the Labor Day 1935 hurricane of the Florida Keys, which was used directly by the United States Army Engineers in cost estimates of hurricane-protection dikes. An investigation of stratosphere heights over the United States, making use of the new radiosonde ascents was started; and various aerological investigations, such as the problem of ice formation on aircraft, thunderstorm electricity, etc., were carried on.

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